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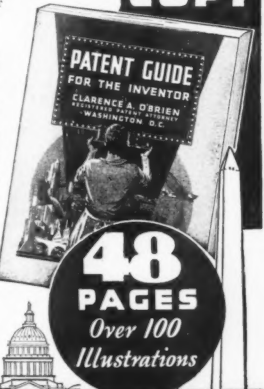

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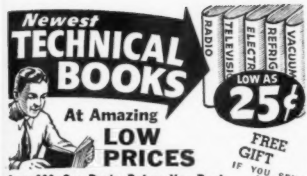

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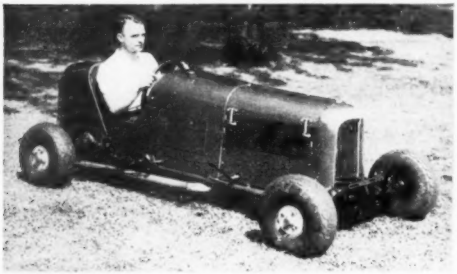

One of the best midget racers ever brought to the editor's attention, this car was built by W. C. Wagner, of Oneida, N. Y. A motorcycle engine and 3-speed transmission enables it to attain a top speed of 75 m.p.h. The wheelbase is 74 inches.

WINNING first prize of $5 in this month's Workbench contest, the photograph above was sent in by W. C. Wagner, of Oneida, N. Y., who has built the finest midget racer I have seen for quite some time. I am sure that every MI midget racer fan will agree that Wagner's car reveals craftsmanship of an A-1 grade.

The car has a wheel base of 74 inches, a tread of 44 inches and stands 30 inches high. The joints of the metal chassis are brazed, instead of bolted or riveted, assuring exceptionally sturdy construction. To facilitate getting in and out of the tiny cockpit, Wagner fitted the car with a small door, the hinges of which are concealed. The tires are of the type used on the tail wheels of huge Curtiss Condor airplanes.

Powered by a motorcycle engine and equipped with a 3-speed transmission, the midget car attains a speed of 75 m.p.h. and travels 40 miles on a gallon of gasoline. Wagner estimates that he spent about 1,000 hours constructing the car, but I think all Workbench readers will feel, as I do, that the time was very well spent. He is willing to sell plans for the car, so if you are interested I suggest you write to him at 437 Sayles Street.

* * *

Attending the annual Motor Boat Show held in New York City a short time ago, I was impressed by the evident growing interest in small boats. The publishers of MI feel that they have contributed greatly to this increasing interest, due to publication of an annual HOW TO BUILD 20 BOATS book, the latest edition of which is now on the newsstands or available from our Greenwich, Conn., office for fifty cents. Boats constructed from MI plans are scattered throughout the country. Hundreds more are under construction in home workshops at this very minute. Every one of these MI boats, built or being built, has inspired the construction or purchase of other boats. Can we be blamed for our pride in thus having boosted the sport of boating?

* * *

A $3 prize was awarded to Clarence Evenson, of Kindred, North Dakota, who sent in a photo of his propeller-driven snow sled. The sled features a light steel frame which is covered by metal auto body material. Capable of a speed of 50 m.p.h. it is powered by an old auto engine which whirls a 5-foot propeller. The runners can be replaced with wheels when the winter season is over. Nice work, Clarence.

* * *

Powered scooters continue to be a popular project with scores of workshop fans and one of the latest brought to my attention is that shown in the photo on page 12. Built by Arthur Drown, of Green Springs, Ohio, the scooter is powered by

[*Continued on page 12*]

This propeller-driven snow sled was built by Clarence Evenson. The body is made of light steel and auto body material. Runners can be replaced with wheels for use in warm weather.

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Editor's Workbench Chips

[*Continued from page* 10]

Ready for a jaunt over the highway, Arthur Drown poses with the powered scooter he built. It is powered by an old washing machine motor of the gasoline type and goes 20 m.p.h.

a washing machine motor of the gasoline type and he claims mileage of 100 miles per gallon and a top speed of 20 m.p.h. Airplane tubing was used for the frame work, being covered with sheet metal to form the body and front mudguard. Art has a sense of humor, calling the scooter "The Mule" because it has to be pushed to start. An MI check for $3 is on it's way to you, Art.

* * *

A photograph of the kyack he built from MI plans won a $3 prize for Lyell Vanatta, who neglected to provide his address. He says the kyack floats lightly with two passengers and handles easily when using either a single or double paddle. Send me your complete address when you read this item, Lyell, and a check will be sent to you immediately.

* * *

A practical method of mounting a gasoline type washing machine motor on a bicycle to power it is shown in the photo on page 14, which won a

[*Continued on page* 14]

MI plans helped Lyell Vanatta build this two-passenger kyack.

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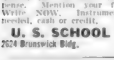

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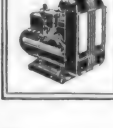

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Editor's Workbench Chips

[*Continued from page 12*]

Every boy dreams of having a powered bicycle, but B. T. Smith made his dreams come true by fitting his bike with an old gasoline type washing machine motor. Friction drive is used.

$3 prize for B. T. Smith, of Tahoka, Texas. The motor is connected to a shaft by means of a V-belt which actuates a rubber-faced pulley that contacts the bicycle wheel through a hole cut in the top of the rear fender, thus making the friction contact that causes propulsion. The weight of the motor plus a small coil spring provides the necessary tension to keep the pulley from slipping. Well done, Smith.

• • •

Larry Eisinger, of New York, N. Y., scored a $3 prize by sending in the photo of his gas-powered model airplane. Featuring a wingspan of almost seven feet, the model is shown in an uncovered state, but he expects to complete it within a few days. Power is supplied by a miniature gasoline motor, the cylinder of which can be seen jutting upward through the nose. Happy landings, Larry.

[*Continued on page 16*]

Ready for covering, this model airplane was constructed by Larry Eisinger. Powered by a miniature gasoline engine of one-fifth horsepower, it has a wingspan of about 7 feet.

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Editor's Workbench Chips

[Continued from page 14]

Adapting an old washing machine motor to a mower simplified the job of trimming his lawn for Charles Miller, of Kent, O.

The job of trimming his lawn will be a lot easier for Charles Miller, of Kent, Ohio, who fitted an old washing machine motor to his lawn mower, as shown above. A swivel connection beneath the point of attachment makes short turns easy, the motor being fitted with a set of wooden wheels. Bicycle chains and sprockets are used to slow down the high speed motor to satisfactory working limits. Very clever, Miller. I'm sending MI's check to Homer L. Jacobs, inasmuch as he sent in the photograph, but I assume he'll "split" with you.

* * *

Photo fan Sidney Preen, of Perry, N. Y., was awarded a $3 prize for his photograph showing the enlarger he constructed from MI plans. He used a 6.3 lens taken from an old camera and reports very satisfactory results. Can't blame you for being so proud of your project, Sidney, for it looks like a well built job, as any photo "bug" will agree.

[Continued on page 18]

Fitted with a 6.3 lens, this MI enlarger produces excellent results, according to builder Sidney Preen.

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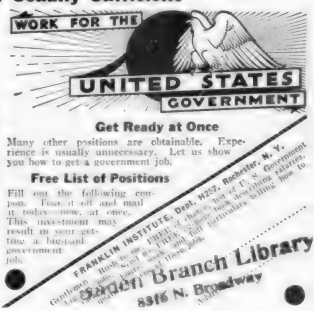
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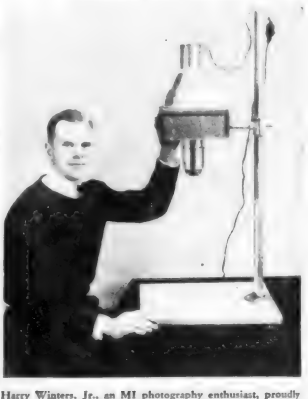
Editor's Workbench Chips

[Continued from page 16]



Harry Winters, Jr., an MI photography enthusiast, proudly poses with the enlarger he constructed.

Another photography enthusiast who was awarded a $3 prize is Harry Winters, Jr., of Bolton Landing, N. Y., shown proudly posing with the enlarger he built. MI plans were used and he claims it is the most practical enlarger he ever constructed. Thanks for the praise, Harry.

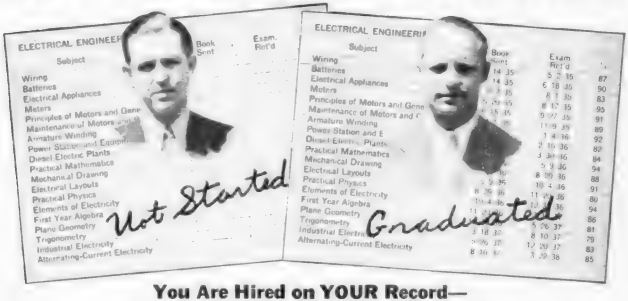
* * *

A photo of the midget car he built for his son Robert won a $3 prize for Howard Huntley, of Black River Falls, Wis. Powered by a motor of one-fifth horsepower, the home-built midget auto

[Continued on page 20]

What youngster wouldn't smile if his dad built him a midget car like this one. Robert Huntley is the proud driver and his dad built the car, which has a motor of only 1/5-horsepower.

On His Record—
Which Man Would YOU Hire?



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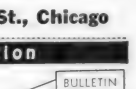

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Editor's Workbench Chips

[*Continued from page 18*]

Top—Roscoe Judd built this model speedboat which is powered by an air-cooled gasoline engine of the type used in model airplanes. Lower photo shows how the boat (arrow) is confined to a circular course by means of a connecting cable held overhead by boy in water.

has a small tank that holds only one gallon of gasoline, yet this is enough for three hours riding. (Maybe you ought to carry an eye dropper full of gas as a "spare," Howard.) You forgot to state how fast the car runs, but my guess is that 10 m.p.h. is tops. How near to the mark am I, Howard?

* * *

A hobby that is slowly, but surely, climbing to new heights of popularity is that of building and operating model speedboats. Speeds of 40 m.p.h. are claimed for some of the tiny water craft, so you can bet there are plenty of thrills in the average race. Shown above is a powered "water bug" built by Roscoe Judd, of Indianapolis, Ind., which is powered by an air-cooled miniature gasoline engine of one-fifth horsepower. He built the boat entirely from a drawing of a runabout designed by Gar Wood, the famous speedboat pilot and motorboat manufacturer, no plans being available. The lower photo shows how the model speedboat is confined to a circular course, being attached to a wire cable held overhead by the operator who stands in the water up to his armpits. I'm sending you a $3 check in the mail, Judd.

* * *

A well earned $3 award goes to Ralph Summers, of Lancaster, Pa., for the photo showing the powered scooter he constructed at a cost of about

[*Continued on page 22*]

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Editor's Workbench Chips

[*Continued from page 20*]

Featuring a compartment for carrying packages behind the seat, this scooter was built by Ralph Summers. A washing machine motor of ¾-horsepower provides a speed of 25 m.p.h.

$18. The frame is made of wood and wrought iron. A washing machine motor of ¾-horsepower provides a top speed of 25 m.p.h. The seat of the scooter features a compartment for the carrying of bundles. Looks like a professional job, Ralph. You are to be complimented on your craftsmanship.

• • •

Money earned by trimming lawns enabled Louis Blaisdell and a friend, of Whitestone, N. Y., to buy the materials used in building the dory shown in the photograph below. Costing $25.22, the dory required one year of spare time effort to complete and represents a first attempt at boat building. Judging from the photo, I'd say you have done VERY well, Louis. Watch for MI's check for $3 in the mail.

• • •

Some very pleasurable summer days are ahead for E. C. Sickel, of St. Paul, Minn., whose home-

[*Continued on page 24*]

Using money earned by trimming lawns Louis Blaisdell and a friend built this dory at a cost of $25.22. Isn't it a beauty?

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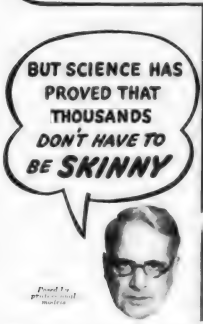

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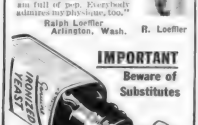

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Editor's Workbench Chips

[Continued from page 22]

Happy summer days lie ahead for E. C. Sickel, who built this *Sunray* sailboat from plans that appeared in MI's boat book.

built SUNRAY sailboat is shown in the accompanying photograph. Built from MI boat book plans, the boat sails very well, according to Sickel, thus living up to the reputation set by other SUNRAY type boats and attesting to his skill in constructing it. If you are planning to build another boat, Sickel, be sure to get a copy of the 1939 HOW TO BUILD 20 BOATS book with fifty cents of the $3 prize money I have awarded to you. I know you'll find it more interesting than any previous issue.

* * *

A $3 prize was sent to Sam Buchiere, of Bristol, Conn., who sent in a photograph of a midget racer he constructed at a cost of $18. The little car is powered by a gasoline motor of two horsepower

[Continued on page 26]

Sam Buchiere constructed this midget runabout at a cost of only $18. A two-horsepower motor with chain drive is featured.

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Editor's Workbench Chips

[Continued from page 24]

A real radio "ham" is Clarence Trost, operator of station W9HMZ, who built this "hobby desk." It features a radio transmitter, receiver, phonograph and drawers for supplies.

and eats up the road at 35 m.p.h., while giving mileage of 60 miles per gallon. A sliding clutch and chain drive are featured. I'll bet the car is a favorite with the local youngsters, Sam.

• • •

A novel project is shown in the photo sent in by Clarence Trost, of Concordia, Kansas, who is a radio "ham." (Call letters are W9HMZ.) It is a "hobby desk" which can be used as follows: (a) the bottom panel is an ordinary radio used for listening to regular broadcasts, the speaker being mounted on the back panel (b) the middle panel is used for playing phonograph records (c) the drawers are for the storage of model plane supplies, plans, etc. A radio transmitter is also built into the hobby desk. Very novel, Clarence, and well worthy of the $3 prize I'm sending you.

• • •

Frequently I receive requests from prospective boat builders for the names an addresses of MI reader-craftsmen in their localities who have already built rowboats, sailboats, etc. If you are willing to correspond with other readers relative to the boat (or boats) you have constructed, please send your complete name and address to me. Don't forget to mention the type of boat you built so that I can classify your letter for quick reference. Address your letter to: Workbench Editor, MECHANIX ILLUSTRATED, 1501 Broadway, New York, N. Y. Who knows, if I get enough letters, the formation of an MI Boat Club may be the next step.

Editor's Workbench Chips

Carrying two persons, this aero-drive ice sled attains a speed of 60 m.p.h. Built by Richard Woods, it features an airplane-type dashboard and an automobile-type steering wheel.

A photo of the aero-drive ice sled he constructed won a $3 prize for Richard Woods, of Saugus, Mass. As can be seen from the photo, the sled has good lines and it is easy to believe Dick's claim that a speed of 60 m.p.h. is attained. The sled features an automobile-type steering wheel and an instrument dashboard that rivals that of any lightplane. Unfortunately, the photo of the dashboard which Dick sent along was too small to reproduce satisfactorily. Here's wishing you plenty of happy "zipp-zipps" over the ice, Dick, but watch out for holes.

•••

Remember the plans for the U. S. Coast Guard Patrol Boat model that appeared in the November, 1938 issue? Well, shown below is the 27½-inch model Stan Craig, of Youngstown, N. Y., constructed from the plans. Isn't it a beauty? Just the thing for decorating a den to give it a real nautical atmosphere. Accept my compli-

[*Continued on page 29*]

Measuring 27½ inches from bow to stern, this model U. S. Coast Guard Boat was made from MI plans by Stan Craig.

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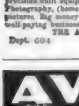

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Editor's Workbench Chips

[*Continued from page 27*]

Tipped over on its nose to show details more clearly, this Lincoln Sportplane was constructed by Sgt. Albert Lessard, Air Corps, shown seated on ground. Swell job, sergeant!

ments for doing such a nice job, Stan; MI's check for $3 is on its way to you.

* * *

In the February issue, I ran a picture of Staff Sergeant Albert Lessard, of the Army Air Corps, riding the motor bike he constructed. Well, the sergeant has scored another Workbench prize of $3 by sending in a photo of the Lincoln Sportplane he built. After eight years service, during which it has had three different motors, the plane is still flying. The present power plant is a 50 h.p. Aeromarine motor. You certainly have proved that home-built planes can "stand the gaff," Lessard. I know I am echoing the thoughts of every amateur aviation fan in the country when I say "Well done!"

* * *

Speaking of amateur aviation, I have been informed that the states of Washington and Utah are considering legislation that would permit home-built planes to be flown within their borders. This is good news, if true. (I am checking the reports at this time.)

As many MI readers know, especially those who have followed the magazine since its early days, the state of Oregon has permitted home-built planes to be flown within its borders for the past 17 years and the amateur plane builders have set up an enviable record for design and safety (See MI, August, 1938.) For years MI published plans for building airplanes, ceasing only when regulations were enacted which made home-built planes illegal in the majority of states. However, in view of the interest readers have expressed in amateur aviation, arrangements have been made with the Private Flyers Association of Eugene, Oregon, to supply us with a few photos and descriptions of home-built planes each month and they will begin to appear in an early summer issue. Watch for these photographs and tell your friends to watch for them, too.

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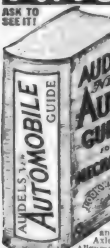

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Development of a new non-crystallizing gum rosin has been announced by the Bureau of Chemistry and Soils of the U. S. Department of Agriculture.

The new gum, a natural rosin secured from pine gum, will not crystallize in ordinary usage, according to the Bureau. It is made by filtering the crude rosin for 24 to 48 hours through a muslin filter after standing long enough for crystallizable portions to separate from the main portions of the liquid. Pressure filtering is not possible because the crystals would liquefy.

Crystallization of rosin is a problem as it makes the use of rosin objectionable in some industries, such as the manufacture of adhesives, core oil, soap and paper size. Pilot plant scale tests show the process to be commercially feasible.

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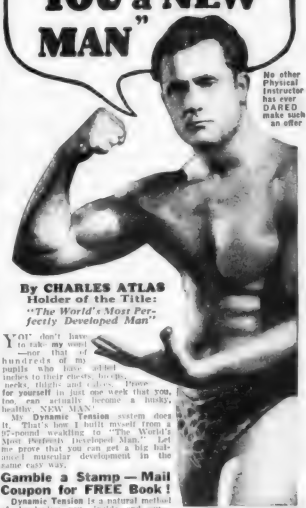

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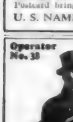

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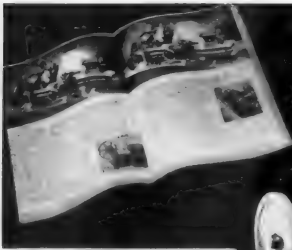

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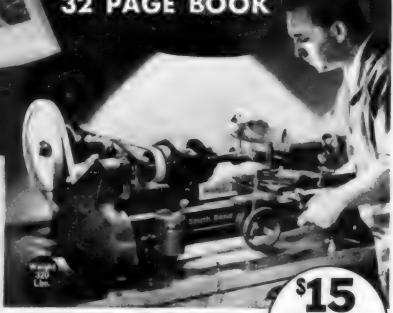

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SYNTHETIC CHEMISTRY: WEALTH FROM WASTE

by John E. Pfeiffer

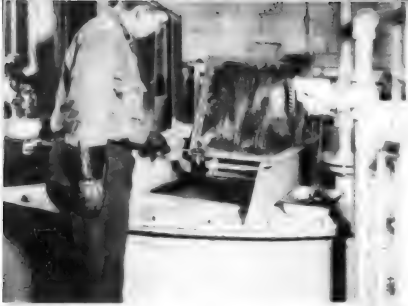
This is the first of a series of articles on the romance of synthetic chemistry in which science has solved the mystery for turning waste into wealth.

"DON'T throw that away!"

This is the battle cry of the great synthetic chemical industry which makes everything from hair-brush handles to T.N.T. from stuff that was once just waste.

If you want to buy some perfume, the odds are that the

Above: Everything synthetic but the models! Cellulose in the window draperies; Tontine window shades; synthetic upholstery; special chemicals in the chromium; Ceramic colors on the tea sets; pyroxylin in rugs; rayon in woman's gown, etc. Below: George O. Curme, Jr., who pioneered in synthetic chemistry and who founded the home of the industry in Kanawha Valley, W. Va.



Left: Chemistry worker is shown testing dyestuff sample from the wash tank in a duPont plant. Below: Benzol plant in the rich Kanawha Valley region of West Virginia where gas is purified for use in manufacture of synthetic ammonia.

bottle will contain odors extracted from coal tar, once a nightmare to factories who paid people to get rid of it.

But today, whether it's waste gas, tar, or peanut shells, the chemists want it to sell back to you again in the form of motor fuel, photographic film, or pipe stems. What men do with rubbish would turn the most efficient housewife green with envy and the whole thing only started late last century.

In 1839 a person's clothes, medicines, and most other necessities were made out of materials taken from plants or animals. Most raw materials came entirely from age-old sources—silk from worms, wool from sheep, and cotton and linen from plants. Plants and trees were the source of rubber, paints, perfumes, and flavors for beverages and desserts. But in the later 1800's scientists began to rid men of their dependency upon natural plants. They started to do near-miraculous things with the thick, oily tar left from heated coal. Flowers and vegetable oils played second fiddle as perfumes, tasty flavors, and life-saving drugs were made from the 200-old compounds that compose the evil-smelling black coal residue. The Germans were leaders in this work and before the World War they had practically cornered the world's synthetic-chemistry market. Hundreds of scientists flocked to Germany to study the art of turning chemical knowledge into dollars and cents.

Among them was George O. Curme, Jr., a young American who came from a small town in Iowa and was living on a very closely figured budget. One day he went to the front door of chemistry's Inner Sanctum, the vast synthetic-products trust, I. G. Farbenindustrie. Hesitatingly he asked an official to take him on a tour through the mammoth chemical works—but he got the German equivalent of the gate. Today Dr. Curme might receive a more cordial answer, for after the refusal the young chemist returned to America—missing the War by a bare two weeks—broke, but with big ideas. Several weeks passed. Then he got a job with an affiliate of the Union Carbide and Carbon Corporation and began tinkering with test tubes in a laboratory of the Mellon Institute in Pittsburgh.

He worked five years extracting chemicals, not from coal tar, but from natural gases that rise up like steam from 10,000 square miles of underground pits in the United States. While many of these gases had been wasting themselves into thin air for centuries, Curme was determined to give them a new job.

Finally things had progressed far enough for a try-out and July, 1920 saw the formation of Carbide and Carbon Chemicals Corporation—a special company to test the commercial possibilities of Curme's research—in the Great Kanawha River Valley near Charleston, West Virginia.

The site was well chosen. Billions of cubic feet of natural gas lay beneath the soil, a large proportion of West Virginia's total reserve of 3,000,000,000,000 (three trillion,) cubic feet. Furthermore, geologists estimated that Kanawha had an untapped coal supply of about 24,000,000,000 tons, enough to last 1,300 years, and the valley also contained oil fields and salt springs for valuable industrial chemicals such as chlorine, sodium, and bromides.

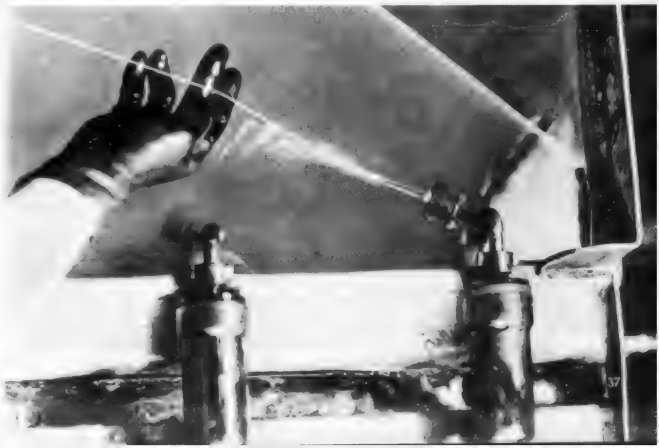
In this gigantic natural supply house, the new corporation grew from a small experimental plant to a huge, 160-acre set of factories stretching more than a mile along the Kanawha River.

The House that Curme built uses a secret process to make such abstract-sounding chemicals as butyl acetate, carbitol, and isobutane. But when these and other substances are juggled by chemists, a legion of practical things pop into being, including artificial leather, films, quick-drying lacquers, aspirin, insecticides, dynamite, and other explosives. One chemical, ethylene gas, helps develop ripe colors in oranges and other fruits; another natural-gas derivative is used in making ethyl alcohol, the potent factor in liquors which had formerly been distilled from grain.

While tons of these products are being turned out annually, Dr. Curme has received nearly every medal chemical societies had to offer. The 50-year-old expert, however, is so shy and retiring that his name is almost entirely unknown outside of scientific circles. Since his early days in the Kanawha Valley, the region has been developed to stupendous proportions. In this "birthplace of the Southern chemical industry" there are now more than 275 manufacturing concerns which employ 15,000 workers and pay them about $20,000,000 a year in wages.

One of the largest plants in the valley is that of the Ammonia Department of the duPont company. This division was built to make ammonia—a compound consisting of one part of nitrogen and three parts of hydrogen—and nothing but. Valuable by-products of various processes, however, were soon found and now the plant turns out more than 100 of them. And they all come from three raw materials—coal, nitrogen from the air, and water.

The first step is to take coal, bake it at high



Below is pictured for the first time the actual chemical transformation of viscose liquid into a rayon thread. The photograph was taken in a duPont plant while the process was in operation. The liquid is forced through the many fine holes in the spinneret. The blur, which was not visible to the naked eye, is the coagulation or actual change of the liquid into cellulose filaments. These filaments later become a rayon thread as shown in the rubber-gloved hand. Rayon has proved to be one of the most famous synthetic products produced by science.

temperatures, and drive off tars and gases. This leaves coke which is ignited and burns to a white heat as air is blasted through it, forming a "blow run" gas mixture rich in nitrogen and carbon dioxide. The glowing coke is then blown by high pressure steam, and "blue gas" is produced containing two important constituents—hydrogen and carbon monoxide. These and more complicated processes are carried out at temperatures as high as 2,400 degrees fahrenheit and pressures up to 2,160,000 pounds per square foot.

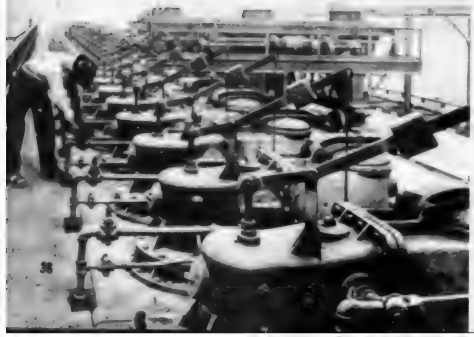
From the quartet of gases—nitrogen, hydrogen, carbon dioxide, and carbon monoxide—the products of large-scale work begin to take shape. Hydrogen and nitrogen unite to form ammonia. Liquid ammonia and liquid carbon dioxide combine into urea—a white crystalline compound—and nitrates which find use as fertilizers for crops and formerly had to be imported. Ammonia is also made into nitric acid and in that form goes into the making of nitroglycerin, dynamite, and other explosives. Hydrogen and carbon monoxide can be made to react to form alcohol for such things as outboard-motor fuels, automobile radiator anti-freeze mixtures, and food preservatives.

To form these products the four initial gases are heated, washed with water and other fluids, cooled, expanded, compressed, and passed over special substances to make them react with one another more quickly. Nothing is wasted. Those gases, which chemical engineers can't make into a solid, are burned as fuel for important processes. The gas plant alone is large enough to meet the fuel requirements of 2,000,000 persons.

While the Kanawha plant can make a host of commodities on its own, many of the chemicals it produces go to other plants. Extra nitric acid, for example, goes to Richmond, Va., where the pass word is "cellulose." This substance is found in wood pulp and is familiar enough in its practically pure form as cotton. But when chemists get through with it, it comes out in many fancy forms.

Mix cellulose with nitric acid and the end results include smokeless powders for hunters, cements, X-ray films, and coated fabrics. Soak cellulose in a strong solution of caustic soda (sodium hydroxide), and you are off on one of the most revolutionary processes in the entire synthetic-chemical industry. The soda-cellulose mixture is dunked in a special solution of carbon disulfide and results in a thick, yellow fluid called viscose. Then the viscose is squeezed spaghetti-like through tiny holes, forming long thin filaments which can be woven into threads. This is rayon for underwear, dresses, and curtains, and more than 200,000,000 pounds of it are made every year by the viscose method alone.

If you want your rayon colored, chemists can supply you with plenty of synthetic dyes. All the brilliant colors of the rainbow come from chemicals found in coal tar, petroleum and vegetable raw materials. But clothes aren't the most spectacular use for man-made colors. In 1935 physicians started to use a red dye, sulfanilamide, in injections and by-mouth doses for streptococcus sore throat, meningitis, childbed fever, and other diseases. When the dye saved the lives of persons who had been given up as hopeless cases, the synthetic chemists had another



The first step in nitrogen fixation by the synthetic ammonia process is to make "blue" water gas. Shown here is the charging floor of a coke oven battery into which coal is fed, heated and volatile matter distilled off, leaving the coke which is used in making the water gas. This is also Kanawha Valley's contribution to the science of synthetic chemistry.

The greatest of all the achievements in synthetic chemistry of perfumery was the development of synthetic musk. Natural musk is worth $40,000 a pound. A step in its synthetic process is shown below. At right is shown an intermediate step in making lilac perfume. Terpin hydrate liquid is poured into this vat. After filtration, it comes out as dry crystals, ready for the next step in its synthetic manufacture.

feather in their caps. Doctors themselves are the last persons to try predicting the future of these medicinal dyes, but two more of them have already been found useful in treating sicknesses—a blue dye for leprosy and a red one for epilepsy.

Coal-tar derivatives and other substances have been built into a wide variety of other medicines. Though commonly known as fuel for dope addicts, cocaine was the first drug used for local anesthesia in tooth pulling. But it was too expensive and so poisonous that it often killed the pain and the patient, too. The chemists, however, came to the rescue, and succeeded in manufacturing a less poisonous drug, less habit-forming, and less expensive. Other synthetic drugs include acetyl salicylic acid (aspirin to you), and the potent sleep producers or hypnotics, veronal, luminal, and noctol.

Perhaps more surprising if not more beneficial than these drugs are artificial perfumes. Natural attar of roses may cost as much as $400 a pound, because 250,000 to 750,000 roses must be crushed to get the oil. But give a chemist two coal-tar extracts—the hydrocarbons C_5H_9 and C_5H_8—and he'll make you a pound of fluid that smells almost exactly the same as a rose and costs only $5. A complicated process using such tricky chemical names as salicylic aldehyde and aceticanhydride results in a substance called coumarin which reproduces the odor of new-mown hay as well as any barn. Given the right equipment and the right chemicals, a worker can fill his laboratory with aromas of violets, lilacs, or heliotropes without a flower in sight. Musk—obtained from the musk deer in Asia—is another high-priced perfume ingredient that can be made cheaply from coal-tar. Although a cat can tell manufactured musk from the real thing, the two

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Skating On "Cooked" Ice

The chemical "ice" (hyposulphite of soda) is "cooked" in a large pot alongside the rink (above) until it attains the desired consistency after which it is poured on the rink floor and smoothed (above, right).

●

It may be hard to believe your eyes, but these bathing beauties are actually playing ice hockey on a semi-tropic beach. The chemical "ice" is smoothed with an electric iron when it becomes scuffed from the skates.

SET up amidst an incongruous setting of palm trees, beach chairs and colored sun umbrellas on a semi-tropic beach at Venice, Calif., a rink coated with a layer of chemically prepared "ice" enables patrons to enjoy the sport of ice skating while attired comfortably in bathing suits. Similar to that used in many motion pictures, the "ice" is made of hyposulphite of soda, which is "cooked" in a large pot alongside the rink floor. When of the proper consistency, the "ice" is poured on the floor of the rink until the desired thickness is obtained and within an hour it solidifies, becoming a good skating surface. To smooth and resurface the "ice" after it has become scuffed by skate blades, it is merely ironed with an ordinary electric iron. The heat of the sun does not impair the surface of the "ice" and it can be used for a considerable time before the necessity of resurfacing arises. Hockey matches played by local bathers and fancy figure skating exhibitions by famous skaters are a common sight on the novel rink. Another use to which the chemical ice may soon be adapted is the construction of high chutes along the shore of the beach down which the bathers can slide smoothly into the surf.

Giant Camera Creates Movie Cartoon's Depth

USED to film such outstanding motion picture cartoons as "Snow White," the mammoth multiplane camera shown at right achieves the screen effect of depth by making the characters stand out from the background instead of appearing to be on the same plane, creating realism never before possible. The camera is mounted to shoot downward, with the lens above horizontally placed drawings, and "breaks up" the drawings into component parts on the basis of their respective distances from the eyes of the observer. The photo above shows how a scene appears through the camera lens. The fence, tree, water, and building drawings are on different levels, but are photographed simultaneously to provide the effect of depth and perspective desired.

Novel Vehicle Travels On Water Or Land

POWERED by a motorcycle engine and capable of carrying a driver and two passengers, a vehicle recently invented in Berlin, Germany, can travel on land at a speed of 8 m.p.h. or on water at a speed of 12 m.p.h. Arrow (upper photo) indicates the propeller that provides propulsion on water journeys.

AIR RAID!

by
Major Al Williams

This is the second of a series of articles on foreign war planes by Major Al Williams, ace speed pilot, who has flown German military planes and studied England's planes in flight. Here are his observations.

England has been planning a captive balloon defense to protect London from air attacks. Experts are at odds as to its effectiveness.

CAN the great cities of the United States be bombed off the map? How effective a defense may be against a determined air raid can be judged by studying attack and defense tactics in Europe. Of all the countries of Europe, England is the most vulnerable to bombardment from the air! If war comes, England expects to be bombed right off the bat.

No one knows how they will stop the bombing plane once an attack is begun. Threat of retaliation—the possibility of an enemy squadron coming right back to bomb the aggressor's homeland—is the most effective medicine to date.

Fast fighting planes can make it hot for bombers, if they get to them in time. Bombers are fast, too, and the time element of warning is reduced to minutes at best. The possibilities of a surprise bombing raid would require the defense to maintain a constant air patrol, and that is as futile as trying to maintain a constant anti-aircraft gun barrage as soon as war seemed to be approaching.

Have We a Defense Against It?

These are Italian bombers over Spain. In the "silent approach" technique, the bombers glide to their objective with motors throttled. The technique fools anti-aircraft batteries and sound-detector units lying in wait for them. Failure to hear the bombers coming results in such devastation as that shown below in Spain.

In the case of the defense of London, the English estimate that they will have only seven minutes to get their fighters to bomber altitude once the enemy is discovered over the estuary of the Thames—if it happens to be discovered at all. How remote such chances of discovery are may be judged from the following experience.

Last summer I was in an air raid in Europe. It was a scheduled raid—to come sometimes during the early morning hours—and I sat in the darkness with an anti-aircraft unit which was laying for the bombers.

The guns, searchlights, and sound detectors were of the latest design. We watched and listened for the attack, and I sat through it all with a pair of earphones clamped to my head. The crew—and it was a crack outfit—was geared to let the bombers have it. They had a service record to think about.

But nothing ever happened. I

This is the Supermarine "Spitfire" with its fixed pitch wooden propeller which the British will rely upon to defend its cities against an air attack.

never heard a peep out of my earphones, and no shot was fired by the guns. The raid came off, all right—up to the point where real bombs would have been dropped in warfare—but we didn't know anything about it until it was all over. The bombers had used the "silent approach" technique.

The silent air raid, of course, was tried out under actual war conditions in Spain, particularly in raids on Barcelona. It's nothing more than climbing to 35,000 or 40,000 feet and then gliding toward the target for the last 40 or 50 miles with engines throttled.

The neatest trick of that operation was perfecting a spark plug that would stand the heat of the pull for altitude, the chill of the long gliding period, and still come back without missing fire after the bombs were dropped and the engines turned up to full throttle for the escape. Such tactics have been giving foreign air forces a headache trying to think up a defense against it.

The British have been thinking up a lot of schemes to protect themselves. Last summer there were rumors about the development of vaguely-defined rays designed to ward off air attacks by frustrating the ignition systems of airplanes.

This bugaboo is an old timer, and even Marconi got no place with it. Launching a fan-like arc of rays into the atmosphere to bring down all planes is the dream of every anti-aircraft expert. And some otherwise level-headed people were pinning hopes on it last summer, but the prayer for defense was the father of the thought.

However, even if such rays are developed in the future, the bombers will still be able to maintain their full jump ahead. Surely no one has even the wildest hope of being able to prevent fuel oil from being pumped into the cylinders of aircraft engines which do not use electrical ignition, and those engines, of course, are Diesels.

Much more tangible but virtually as ineffective as a defense plan is the balloon apron which the British have fiddled around with for some time now. Such an apron was first tried out by the Germans at Hagendingen during the World War. It was set for Allied bombers operating from Nancy, but it was a complete failure since it couldn't be used when the wind

velocity was higher than 15 miles per hour.

Heralded as a most important factor in the air defense of England is the new 3.7 A.A gun, listed as the chief weapon of the Territorial Anti-Aircraft Batteries. As a matter of fact, I didn't see that gun in operation, but even the most enthusiastic and partial observers daren't rate it above the German guns tested in Spain, which I know from authentic records are not depended upon for accurate fire above 10,000 feet.

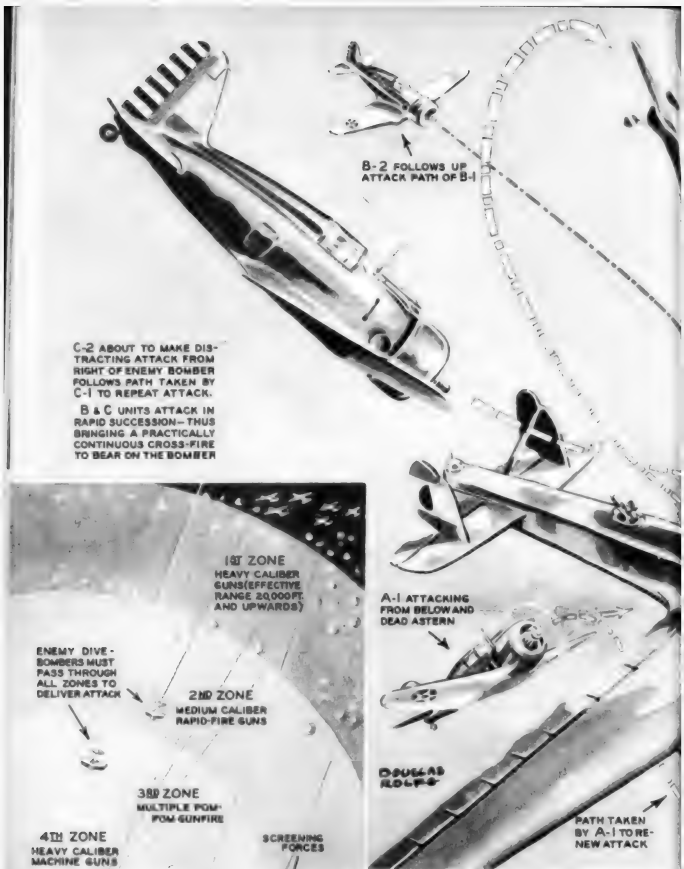
Anti-aircraft gunners take their worst licking in trying to shoot down the "Queen Bee" target planes, developed several years ago by the British. They're very similar to the robot, radio-controlled target planes the movie comedian, Reginald Denny, is building for our own Army.

The British Navy has had a terrible time hitting the Queen Bees, and their score is disastrous. The anti-aircraft gunners have done no better at knocking the little robot planes out of the sky.

There is one angle about the robot planes to give us all pause, though. As they now stand, they have a wingspread of about 12 feet, cruise at approximately 75 miles per hour at an altitude ceiling of about 8,000 feet. They take off by catapult, and radio control takes over from there and each maneuver is

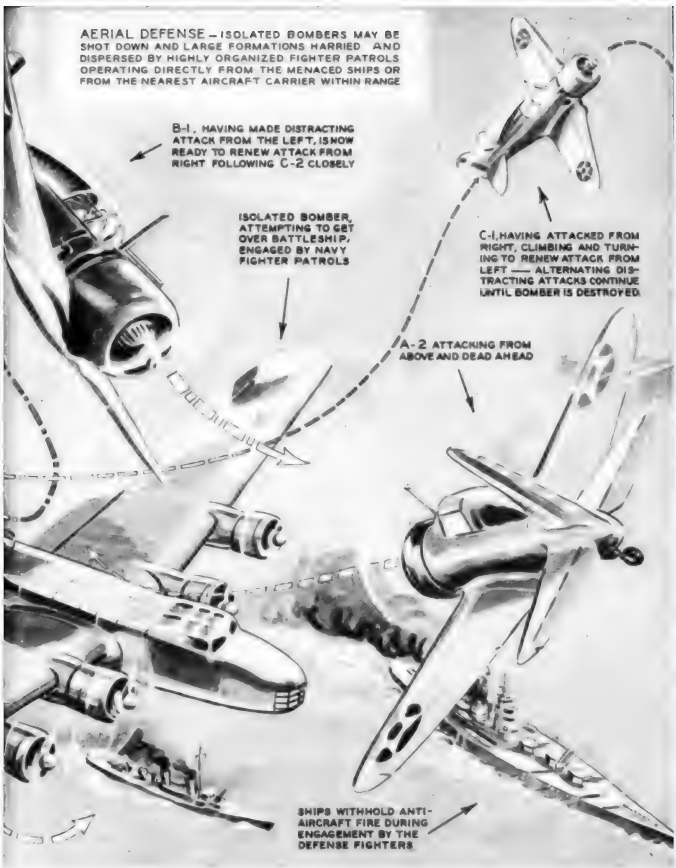
[*Continued on page 86*]

Above: fanciful view of a bomb-proof, gas-proof cellar in London. Whether or not such retreats will stand the gaff of frantic air raids has yet to be proved. Below, The new Hawker "Hurricane" British fighter, a high-speed pursuit ship that has done better than 350 m.p.h. It's among Britain's first line of defense.



Battleship vs. Bomber

Mechanix Illustrated—April, 1939



WITH war clouds hovering over the world, the old argument as to whether aircraft could successfully attack and sink battleships has once more become a topic of public interest. Only a war involving two or more major powers will provide the answer. In the illustrations above, an MI artist depicts how two-unit flights of defensive fighting planes might engage a bomber, attacking it from various angles simultaneously. Using the full gun power of its anti-aircraft batteries, the battleships alone could well hamper formations of bombing planes, say Navy men.

BATTLESHIP vs. TORPEDO-PLANE

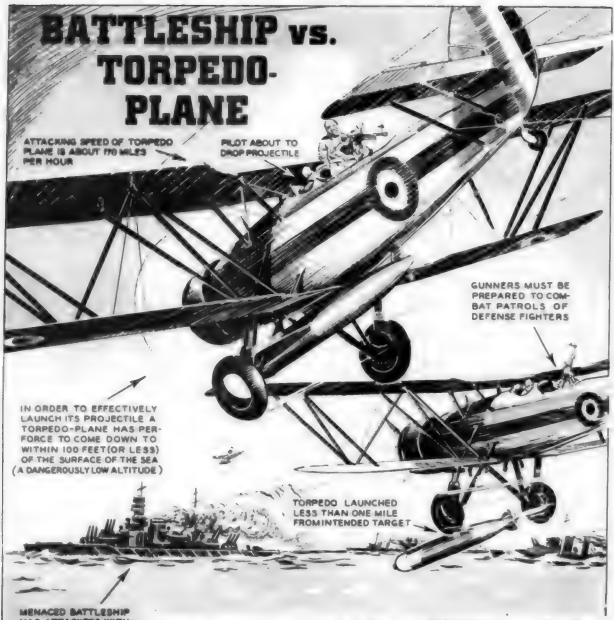


DIAGRAM OF TORPEDO ATTACK SHOWING ZONES OF INTENSIVE FIRE HOSTILE PLANES MUST TRAVERSE IN ORDER TO LAUNCH PROJECTILE

Although torpedo-plane attack of battleships has yet to prove its practical worth under actual war conditions, many naval authorities have expressed the opinion that such attacks are more to be feared than bombing, but proponents of the invincible battleship theory claim that the attacked warships' anti-aircraft fire would be deadly to the low-flying planes. The technique of attack and the difficulties which would be encountered by the planes is shown in the accompanying sketches.

Device Sells Life Insurance

LATEST of the coin-operated machines is that shown above, which issues a $7,500 insurance policy, good for 24 hours, to persons who drop a quarter in a slot. The beneficiary's name is recorded by means of a special built-in pencil and pad device, eliminating forgery or alteration.

Light Guides Golfer's Putt

DESIGNED to help golfers perfect their putting swing, a new battery-operated electric device can be attached to the shaft of a putter (above) and flashes a red light when the player deviates from a perfect pendulum swing. The tripping of the light switch is caused by the upset of a balance when the golfer's swing is incorrect.

Visual Defect Makes Boy See Upside Down

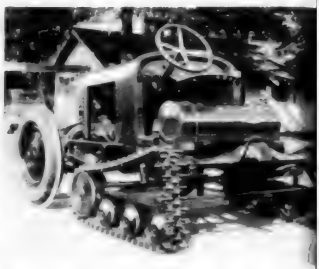
DUE to a peculiar visual defect, Frank Balek, 12, of Chicago, Ill., sees all objects upside down, but he has managed to overcome obstacles which educators once classified as hopeless, attaining grades of 85-90 in such subjects as writing and free-hand drawing. He can also read books rapidly, although the pages must be held in an upside down position. In the photo at right, Frank has written a message which you can read by turning the page around. Note that he starts writing at lower right and works upward.

X-Ray Detects Flaws In Tires

ENABLING service station attendants to determine whether an auto's tires are harboring some hidden hazard which carries the threat of tire failure at every turn of the wheel, a portable tire X-Ray machine (above) has been developed by a well known tire manufacturer. To operate it, the automobile is elevated several inches above the floor and the X-Ray machine is rolled under one wheel. Protective flaps confine the rays to the section of tire being inspected. Exposed by the X-Ray, nails, broken cords, etc., are easily detected (insert).

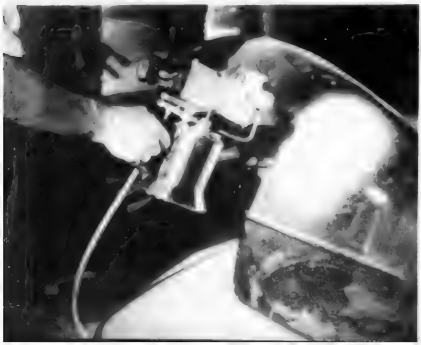
Tractor Tread Fits Autos

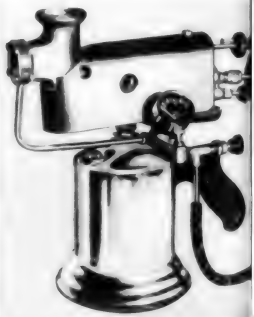
CAPABLE of being adapted to the rear end differential of any car that can travel at a speed of 40 m.p.h., in place of the regular wheels, a new type of tractor mechanism (below) provides ample traction for pulling one 18-inch, or two 12-inch plows at speeds up to 5 m.p.h. Completely assembled, the tread and operating mechanism weigh about 2,000 pounds. Detachable guide rims on front tires facilitate steering on soft ground.



Torch Sprays Molten Metal

USED like a conventional blow torch, a newly developed device (below) sprays molten tin-lead alloys and is a valuable aid for garagemen, metal workers and model makers. Operating for four hours on five cents worth of gasoline, the torch can be used with any air supply line providing a pressure of from 30 to 100 pounds.





Test Lip-Stick On Guinea Pig

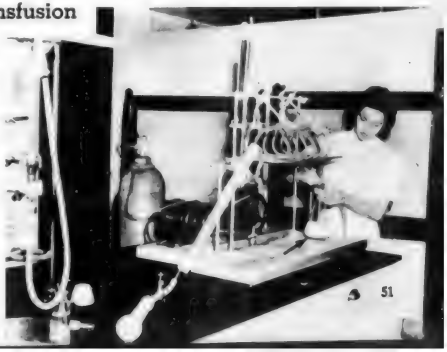
IN THE photo below, Max Factor, Hollywood make-up specialist (left) and Dr. J. R. Pratt, chemist, are testing a new lipstick on a shaven guinea pig (circle). A baby guinea pig is used for the test because its under skin is ten times more sensitive than that of a human being.

Megaphone Features "Mike"

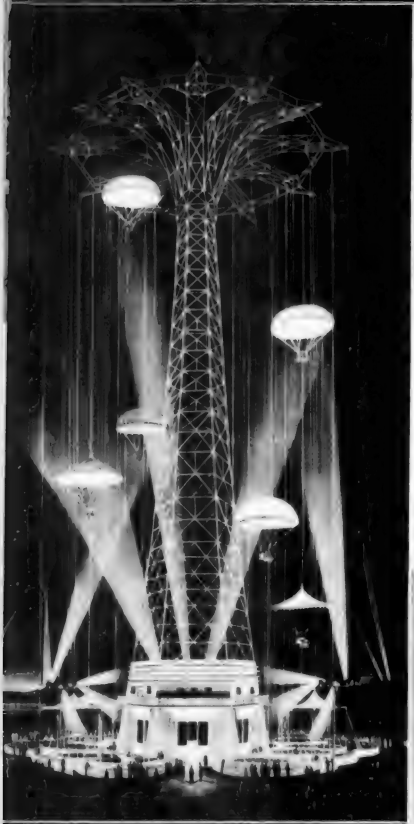
OPERATED by batteries carried in a leather case slung over the shoulder by means of straps, as shown above, a new microphone-megaphone enables an announcer to speak in soft tones, yet have his voice heard by persons standing far away. Specially designed for use at stadiums and other places where crowds gather, the device has also proved valuable in helping policemen direct traffic.

Powdered Blood Mailable To Hospital For Transfusion

A PROCESS whereby blood can be dehydrated into powder form, facilitating shipment by air mail to distant points where it can be used for transfusions and other medical purposes merely by adding water, has been developed by Dr. J. M. Hill, of Dallas, Texas. The process consists of clotting the blood to remove the cells and placing the serum under a vacuum to remove the water. The resultant powder is stored in vacuum flasks (arrow).



Sensational THRILL RIDES



Something new in thrill rides excites those who take the 250-foot parachute jump from this spectacular tower specially designed for the World's Fair. Instead of losing the ground with a thump, the fall will be "broken" by special rubber cushions atop four poles illustrated at right. Spring suspension softens the landing.

Two in a seat, securely strapped-in. These precautions make the parachute jump safe for all.

HOW would you like to experience the thrill of a parachute jump—without the accompanying dangers of the 'chute failing to open, of being blown out to sea or of landing in a tree? Well, that thrill will be yours if you are one of the lucky 60,000,000 expected to visit the New York World's Fair after it opens on April 30. As a matter of fact, a safe parachute jump will be only one of the many sensations ingenious engineers have invented for the Fair visitor's amuse-

Invented for N. Y. World's Fair

by Stanley Gerstin

The stratoship zips and zooms at crazy angles and the 15-foot tube in which you ride turns over as it flashes through the air at the end of a 36-foot revolving truss.

The inventor's mind also thought up this spectacular aerial ride for Fair visitors. Each ship is equipped with a rudder and stick and flying enthusiasts can glide and climb within limits of the anchoring cable.

ment. If the 'chute jump seems tame, try th
aerial ship which the rider can pilot himsel
It's safe, of course, because a cable keep
the ship anchored to a revolving pole, but yo
can turn or stall in a steep climb or experien
the sensation of a power dive, if you are up to

e parachute jumping tower has been
rded concession No. 1 at the Fair because
s spectacular features. It will be the
est of its kind in the world—250 feet high,
ivalent to a 25-story building—and 11
y colored parachutes will be in constant

Gasoline powered midgets on a banked oval track that also turns as the midgets race around the turns will provide thrills for those who like to "open her up." Speeds up to 10 miles an hour may be possible with these galloping midgets.

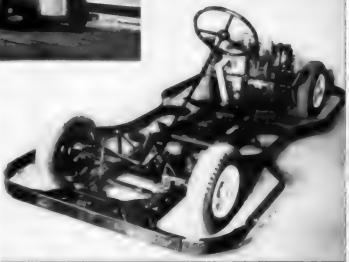
operation. The 'chutes are permanently open on metal spreaders. Passengers are strapped into the seat (which holds two at a time) and are hauled to the top of the tower by a cable and electric hoist. An automatic release starts the drop. The 'chute, which is guided by four vertical wires to prevent it from swaying and drifting, glides gently to the ground. A special arrangement of shock absorbers "breaks" the landing so that the 'chute comes to an easy rest.

Invented by Commander James H. Strong, (retired) for the original purpose of training fliers to parachute from their planes, it was decided to convert the idea into an amusement offering when it was realized that everyone who saw the tower wanted to take a ride —and was willing to pay for it. A smaller version, first tried out at the Chicago Fair, indicated that the parachute tower is destined to become a permanent part of American midways, just as no amusement park is complete without its roller-coaster.

It's a step from an airplane out into the open spaces in a parachute. The reverse of this will be true at the Fair, where it will be just a step from the parachute jump to the aerial joyride where the air enthusiast can pilot his own plane. The only catch is that the plane is hooked to a cable—fortunately! Sixteen planes will circle in a 140-foot radius around a supporting tower 65 feet in the air. The planes are designed with a smooth-action, synchronized double-rudder, controlled by a "stick" which permits the rider to maneuver the craft in an alternate climb and glide action.

A flight to Venus in an 80-foot rocket ship will be another thrill ride awaiting Fair visitors. Movies create the illusion inside the ship.

The 8 hp. motorcycle-engined midget marvels shown at left and below will be available to World's Fair visitors for a roaring ride around a 700-foot track whose nearly flat turns simulate midget racing track conditions. Non-safety bumpers that extend completely around the car.



Under skillful handling the plane can be made to climb and bank past the perpendicular and to swoop earthward from the top of the climb to within a few feet of the ground. Designed by Norman Bartlett of the Spillman Engineering Co., the aerial joyride will be another invention which will make a permanent contribution to the fair midways everywhere.

Aerial conscious inventors have given free play to their imaginations, and have developed the Stratoship for the amusement of space-minded thrill seekers. This is a ship of rocket-like design which pivots at the tip of a 26-foot boom. The truss carries the ship high into

[*Continued on page* 91]

The bobsled promises to be one of the most thrilling rides at the Fair. Dropping from a height of 85 feet, the sled "takes" a dozen sharp turns a-mile-a-minute.

AN MI BOAT IS LAUNCHED

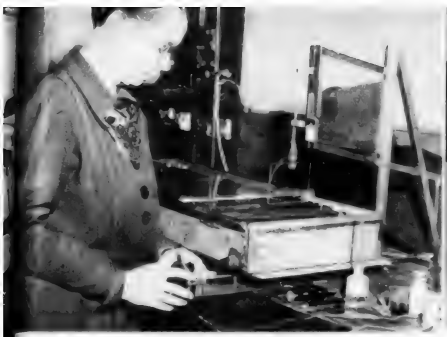
Monsoon is christened with a bottle of Pacific Ocean water. At left: Bow view of the hull with planking finished. Note heft of the stem and diagonally-planked bottom.

Below: The builder and his wife inspect *Monsoon's* frame. Transom can be seen in background. The rugged strength of her construction shows clearly in photo.

BUILT from the MI design *Buddy* by Sam Rabl, this 18-ft. auxiliary sloop went overboard recently at Detroit. Her builder, Roland J. Rosinski, adhered strictly to the MI plans in this, his first attempt at boat building. She was built largely of scrap lumber, and her bolts were hand-forged. A 2-cylinder, 5 h.p. motor gives her a speed of 7 miles. Says Mr. Rosinski: "First class, A-1, 100% ship—a thorough success, a feather in Rabl's cap and a tribute to MECHANIX ILLUSTRATED."

Our boat fan readers will be interested to know that we have blueprints available for this boat as well as many other equally good designs, and that the new 1939 edition of "How To Build Twenty Boats" is now on the stands.

Afloat, waiting for a breeze and a hand at the tiller. She was trimmed with mahogany salvaged from a dismantled cruiser. Outside ballast consisting of 170 lbs. of lead was used to steady her in the choppy waters of the St. Claire and Detroit rivers. A comfortable cabin with cruising equipment for two persons and a self-bailing cockpit make her a real little ship.



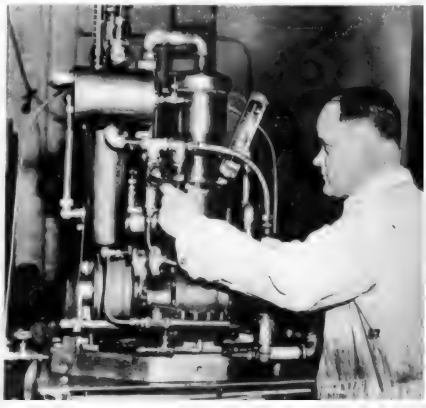
Woman Scientist's Process Makes Glass Invisible

GLARE from reflected light, which has made it difficult to see pictures framed under glass at certain angles, has been removed by a new process developed in General Electric's research laboratory by Dr. Katherine B. Blodgett (above). By applying thin chemical films to the surface of glass, Dr. Blodgett has been able to nullify or neutralize rebounding light rays with the result that pictures framed with glass so treated appear as though there was no glass at all, regardless of the angle viewed from, as represented by center panel section of the portrait above.

The process consists of building or attaching to the glass a very thin transparent film of about four millionths of an inch, or exactly one-quarter wave length of light, in thickness. As light falls upon the film, rays are reflected from both the upper and lower surfaces. With the film exactly one-quarter wave length in thickness, the rays coming from the outer or upper surface are equal in intensity to those rays reflected from the lower surface, thus counteracting one another, and no light is reflected. The non-glare treatment of glass promises to have a wide-spread application in the field of camera, telescope and all other type lenses, including eye glasses although the process is still in the laboratory stage.

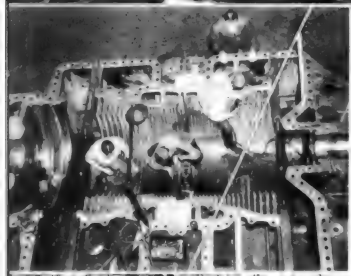
Develops Simplified Air Compressor

DEVELOPED by Archie Jones, a house painter in Los Angeles, Calif., a new air compressor machine has only four main parts as compared to the 50 found in the average type and is said to compress the air with a negligible production of heat. Cooling is accomplished by circulating oil instead of by water jackets, thus eliminating considerable weight. Jones credits Howell N. Tyson of the California Institute of Technology as his collaborator.



Building America's LARGEST MERCHANT SHIP

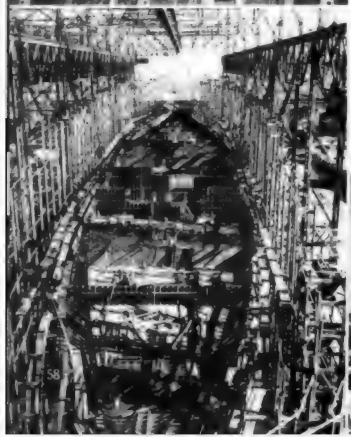
Shown below is an artist's conception of the ocean liner *America* as she will appear when completed. Her 723-foot length will make her the largest merchant ship ever constructed in this country.



NOW under construction and scheduled for launching in the summer of 1940, the ocean liner *America* of the United States Lines will be 723 feet long, making her the largest merchant ship ever built in this country. When completed, the ship will have a beam of 93 feet and will be 75 feet deep from promenade deck to keel.

Featuring the latest improvements in marine design and naval architecture as well as safety devices and fireproof construction, the *America* will have accommodations for 1219 passengers and a crew of 639. Powered by steam turbine engines developing a total of 34,000 horsepower, the ship will ply the ocean lanes between New York and English Channel ports. The name *America* was given to the liner because materials from every state in the Union are being used for its construction.

Left—This is how the hull of the future ocean liner appears at present stage of construction. Below—A 15-foot model enables draftsmen to make scale drawings of each metal plate used in constructing the hull of the full-sized ship. The drawings are then used to make full-scale patterns of the plates. Left, above—Workmen assembling one of the four low-pressure steam turbines that will drive the mammoth liner.



Novel Beverage Refrigerator

FEATURING seven revolving shelves which accommodate 504 bottles, this novel electric beverage refrigerator display unit measures only 37 inches in diameter, saving floor space while advertising many brands.

Develops "Transparent Book"

A TRANSPARENT picture book, which tells its story by laying one page atop another, as shown above, has been placed on exhibition in New York, N. Y. The pictures in the book are arranged on the transparent pages in order and as the viewer turns the pages, laying one atop the other, he builds a picture showing the development of whatever is the subject of the "story." Developed by Dr. S. Theo Jonas, Chicago dentist, as a teaching technique, the novel book can be applied to advertising and allied fields.

Fair Exhibit To Show Man-Made Lightning

CONSTRUCTED by the General Electric Company for installation in Steinmetz Hall at the New York World's Fair, the artificial lightning generator shown here will send a 10,000,000-volt stroke across a 30-foot gap for the edification of visitors. The photo shows the generator hurling a man-made bolt between two banks of capacitators, each of which can build up a charge of 100,000 volts within 15 seconds. The discharge causes a roar similar to thunder.

HILLS OF WATER FOUND IN PACIFIC

Nic Sprank Offers $5.00 For Best Oddity

HILLS OF WATER! — IN THE PACIFIC OCEAN THERE ARE AREAS WHERE THE WATER IS HIGHER THAN THE GENERAL SURFACE LEVEL

E. J. Smithson, Hollywood, Cal.

NEVER MOVING NAIL! IF A NAIL IS DRIVEN INTO A YOUNG TREE A SHORT DISTANCE FROM THE GROUND, THE NAIL WILL REMAIN THE SAME DISTANCE FROM THE GROUND, REGARDLESS OF HOW HIGH THE TREE GROWS. — *Sully O'Hara, Chicago, Ill.*

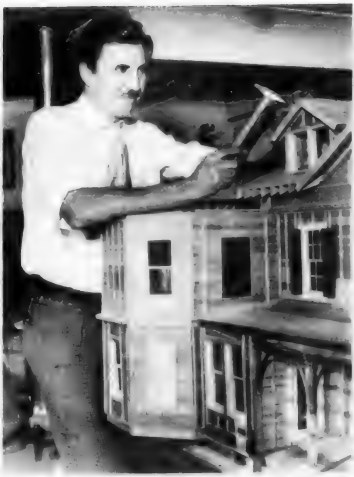
HOT SPRINGS AT THE POLE! THERE ARE HOT MINERAL SPRINGS NEAR THE POLAR CIRCLE, HAVING TEMPERATURES UP TO 194 DEGREES FAHRENHEIT

N. Smith, Miami, Fla.

400,000,000 FENCE POSTS! REBUILDING FARM FENCES IS A BIG JOB, USING AT LEAST 400,000,000 POSTS IN A YEAR IN THE UNITED STATES

G. Cohen, New York, N.Y.

Five dollars will be paid for the oddity selected by Nic Sprank as the best of the month. One dollar will be paid for all others used on this page. Send your oddity to Nic Sprank, Editorial Office, MECHANIX ILLUSTRATED, 1501 Broadway, New York, N. Y. Source or proof of each oddity must be given. Send all oddities separately, not with other manuscripts or letters.

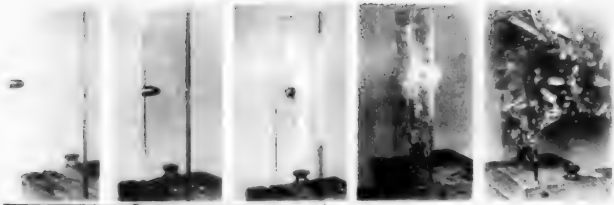


Scale Model Of President's Birthplace To Feature Stones From 48 States

A MODEL of President Roosevelt's birthplace in Hyde Park, N. Y., (right), which will feature wings constructed with native stones from 48 states, is being built by Robert MacKellar 3rd, of Peekskill, N. Y. The photo above shows some of the stones contributed by state governors, Admiral Richard E. Byrd, and Sarah Roosevelt, the President's mother.

X-Ray Tube's Radiation Valued At $90,000,000

MEASURING 56 inches long, 3½ inches in diameter and mounted vertically within a transformer (right), a newly developed X-ray tube provides radiation equivalent to about $90,000,000 worth of radium, which is more than 12 times the value of all the radium available in this country. Operating at 1,000,000 volts and designed primarily for medical use, the new tube can also be used industrially for radiographic examination of steel castings five inches or more in thickness.



High Speed Photos Show Bullet's Flight

TAKEN by an ordinary miniature camera at a record exposure of one-millionth of a second, the photos above, showing a bullet in flight and crashing through a pane of glass, were made by Drs. F. W. Godwin and A. O. Walker, of the Armour Institute of Technology in Chicago, Ill. The bullet was fired (left) so that it passed just below the two poles of a spark gap. The gases from the firing of the bullet trailed the missile and changed the condition of the spark gap, causing it to discharge 38,000 volts through a thin vacuumized glass tube, thus producing the intense light which made the photographing possible. Dotted line indicates bullet's path under spark gap poles.

Novel Auto Windshield Predicted For 1945

DEMONSTRATED at a recent convention of the Society of Automotive Engineers held in Detroit, Mich., the huge streamlined curved windshield shown at left was presented as a possible feature of the roadster of 1945. Made of a special flexible "glass," the windshield is a type that is used principally on airplanes and speedboats at present.

Piano Has Two Keyboards

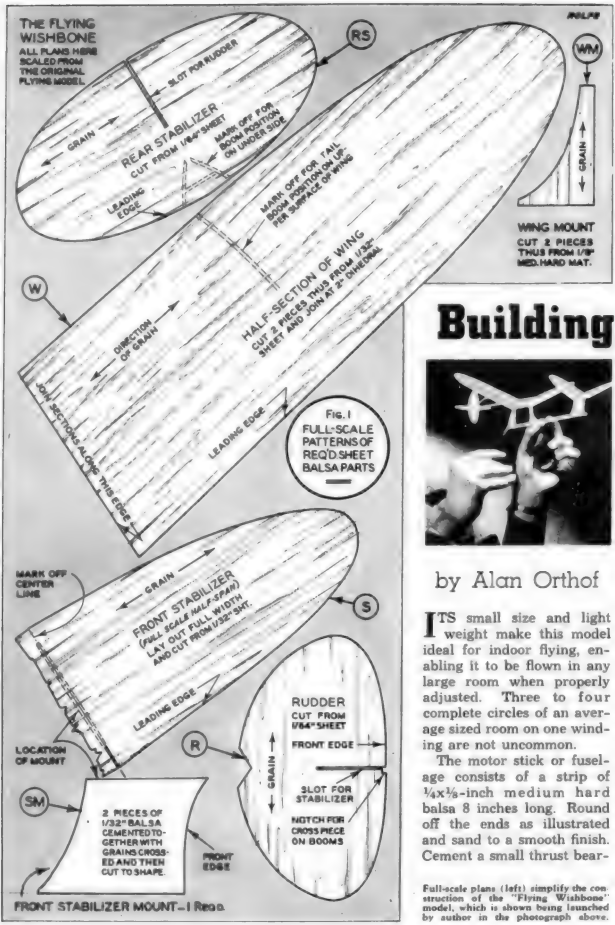
FEATURING two keyboards, one of which is tuned an octave higher than the other, a newly invented piano is said to be easier to play than the standard one-keyboard type, particularly for children who have difficulty reaching widespread chords on the single keyboard. The two keyboards can be played separately or together, control being accomplished by means of a pedal coupler operated by the player's feet.

Gym Bar Holds By Pressure

CAPABLE of supporting persons weighing 250 pounds, a new gymnasium bar can be attached to a doorway without nails or fasteners which mar the woodwork. Consisting of two tubes, one within the other, the bar has rubber-faced ends and pressure holds it in place against the door frame. The length of the bar is controlled by turning the outer tube to the right or left.

Miniature Locomotive Made Of Auto Parts

FEATURING parts salvaged from old automobiles and farm equipment, the miniature steam locomotive shown here was constructed by Edgar Strahn, an auto repair man in Bogalusa, La. The front of the locomotive was made from a brake drum, the cow-catcher from an old harrow and the side rods from a plow. Traveling over 1,000 feet of wooden track, the locomotive is used to provide rides for happy neighborhood children.



Building

by Alan Orthof

ITS small size and light weight make this model ideal for indoor flying, enabling it to be flown in any large room when properly adjusted. Three to four complete circles of an average sized room on one winding are not uncommon.

The motor stick or fuselage consists of a strip of ¼x⅛-inch medium hard balsa 8 inches long. Round off the ends as illustrated and sand to a smooth finish. Cement a small thrust bear-

Full-scale plans (left) simplify the construction of the "Flying Wishbone" model, which is shown being launched by author in the photograph above.

ing to the rear of the motor stick and wrap with thread for added strength. The front hook is bent from No. .020 music wire.

Cut the wing mount from medium-hard 1/16-inch sheet balsa. Be sure that the grain runs perpendicular to the motor stick. Sand smooth and inlet the mount 1/32-inch into the fuselage. Cement firmly and allow to dry.

The stabilizer mount is cut from two pieces of 1/32-inch sheet balsa. This is also inlet into the fuselage, as shown in sketch.

The wing halves are cut from 1/32x2-inch sheet balsa, sanded to about a 1/50-inch thickness at the tips. Start sanding from the center and in one direction only. When you have finished, cement the halves together so that there is 2 inches dihedral under each tip.

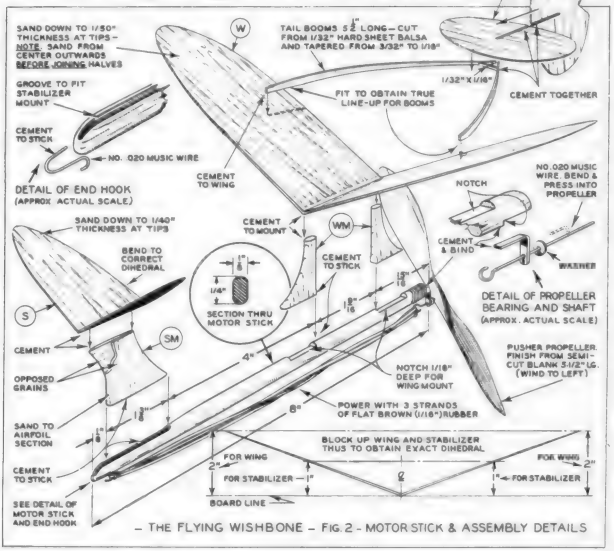
The front stabilizer is also cut from a piece of 1/32-inch sheet balsa, 1 1/2x6 inches long and

[*Continued on page 93*]

Unusual in design, this pusher model flies well indoors.

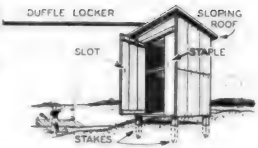
Below—The completely assembled pusher-type model plane. Sketch at bottom of page clearly shows all assembly details.

the "Flying Wishbone"



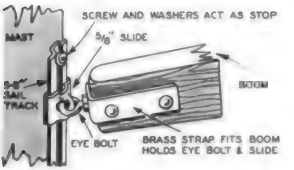
— THE FLYING WISHBONE — FIG. 2 - MOTOR STICK & ASSEMBLY DETAILS

SHORT CUTS FOR BOAT OWNERS



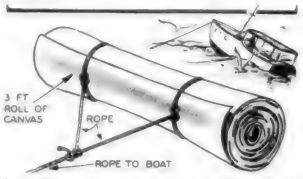
Duffle Locker Made Easily

TWO large packing boxes can be made into an excellent oar and duffle locker, in which can be kept oars, anchor and other gear. Cut a slot in the front door so that it can fit over a staple to which a lock can be attached.



An Inexpensive Gooseneck

THE gooseneck shown above can be constructed easily, and is very efficient. A hole large enough to take an eyebolt is drilled in the center of the brass strap. The eyebolt then is fastened to the strap by two nuts, one at the outside and the other on the inside. The strap is approximately $\frac{1}{4}$ inch thick and is fastened to the boom by two bolts.

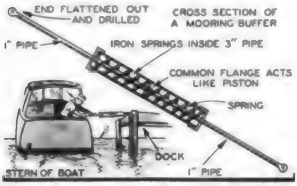


An Emergency Sea Anchor

A TARPAULIN or blanket rolled up as shown in the drawing above becomes an excellent sea anchor. The roll should be approximately 3 feet long and one foot in diameter.

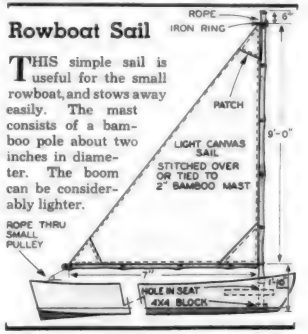
Buffer Protects Small Boat

THIS mechanical bumper will be found very useful when tying a boat to a pier or float. It consists of a three-inch pipe fitted with opposing springs, separated by a piston to which is attached rods—one to be connected to the boat and the other to the float. A cap is fitted over each end of the pipe to keep the springs in place. When in use, the bumper gives to pressure, yet tends at all times to return to the correct position. In this way, chaffing of the sides is eliminated.

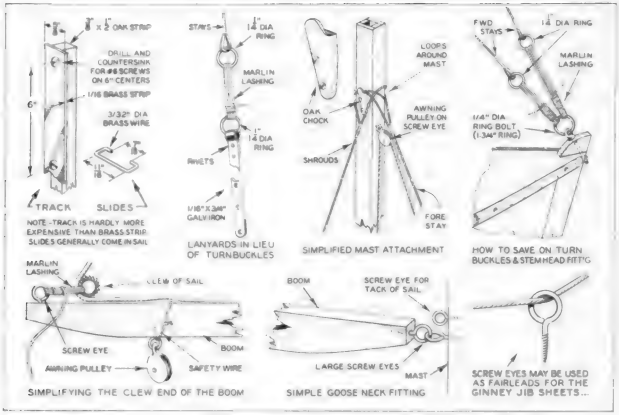


Rowboat Sail

THIS simple sail is useful for the small rowboat, and stows away easily. The mast consists of a bamboo pole about two inches in diameter. The boom can be considerably lighter.

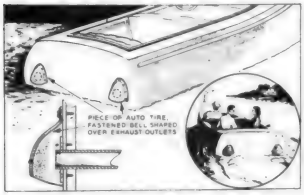


Money Saving Hints For The Sailboater



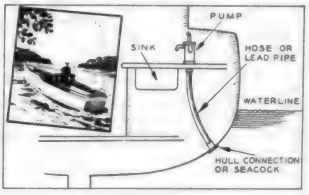
Above are seven ways in which money can be saved on fittings turnbuckles, etc., by those building their own boats, or present owners who need to replace worn equipment, and do not wish to invest much in expensive accessories. The use of lanyards and deadeyes (in this case rings) in place of turnbuckles is an old and sound nautical practice. Deadeyes proved their worth in the old square-riggers long before turnbuckles were ever heard of. Naturally the marlin must occasionally be replaced, but even turnbuckles have been known to "freeze" as well as break at a crucial moment in a race.

Muffling An Over-Noisy Motor



A TRIANGULAR piece of light tire casing fastened over the exhaust helps muffle a very noisy engine without loss of power. Keep the bottom two to three inches out from the end of the pipe to permit exhaust and cooling water finding their way out. It will also prevent exhaust fumes from blackening the transom or finding their way into the cockpit when running before a following wind.

• Fresh Water Supply Inlet



IF YOU cruise in fresh water you should have an inlet through the bottom ending in a pump over the sink so you can have water by pumping a few strokes instead of having to dip over the side. Or the water line from your regular tank can be connected with the outside line by a valve fitted so the pump can suck from the tank in harbor or from outside when you are in clean water.

PRESSURE

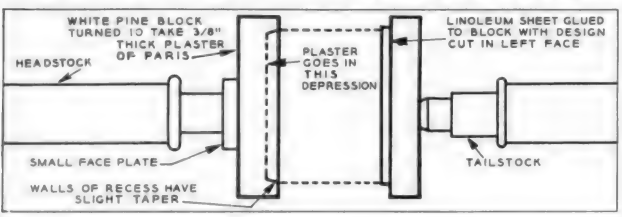
Attractive wall decorations are these lathe-made plaques. Any design or color you wish may be used; size and shape can be varied.

CASTING decorative plaster plaques under pressure is effective and simple. The only equipment you will need is a wood lathe and drill press. The only parts you will need are a wood block, slightly hollowed out to take the plaster, and another block on which has been glued a square of linoleum. The face of this linoleum block is routed out along the lines of the design of the plaque and waxed with paraffin. Then it is forced against the soft plaster in the other block, the pressure being applied evenly and firmly with the tail stock wheel, until a perfect cast has been made. Thus attractive plaques can be made on a production basis if desired.

Glue a square of battleship or other linoleum without pattern on a white pine block. On this trace the outline of the picture to be used. A silhouette from a current magazine or any other design that strikes your fancy, will do. If desired, this pattern can be glued right onto the linoleum. Then with a router bit in the drill press chuck, cut out the waste carefully, allowing the point to bite about $\frac{1}{16}$-in. into the linoleum. The portion to cut out is that portion of the design which, in the plaster, will be the high portions. A small hole should be made on the back side of the pine block exactly in the center of the picture. The tail stock center later goes here.

On a small face plate fasten a pine

Left: Routing out the linoleum block in the drill press. Remove the sections you want raised in the plaque. Diagram below illustrates how plaque is pressed from the wet plaster on the lathe.



CASTING PLAQUES

by Dale R. Van Horn

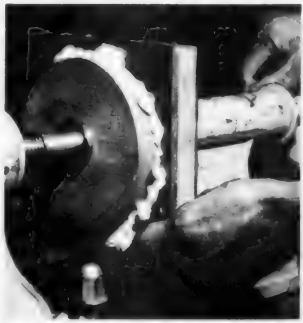
Coating the pine mould with liquid paraffin. If intended for wall hanging, a small picture frame hanger can be laid in the bottom, with nail in place, before filling with plastic.

block. Turn this down as shown and cut a recess with slightly sloping walls, flat bottom and not more than ½-inch thickness. Brush hot paraffin over the depression and wipe off the surplus with a rag at rather high speed. This prevents plaster moisture from swelling the wood.

Wipe hot paraffin also over the linoleum block and remove the surplus. The wax at the bottom of the router cuts will slightly round the lower edges and will prevent the linoleum from sticking in the plaster later.

Now mix a small amount of plaster of Paris not too thick, spread it evenly and fill the waxed recess on the head stock. Fit the linoleum block on the tail stock center and force it tightly against the plaster. This will force out excess plaster and make a firm plaque.

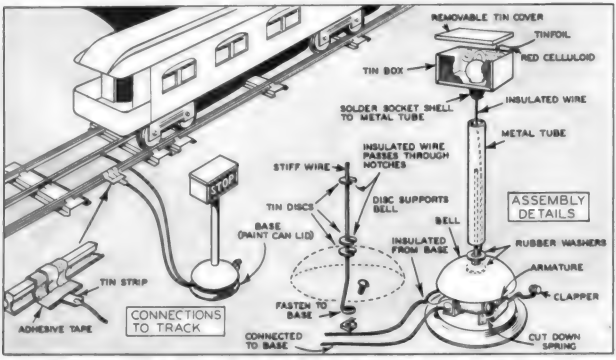
The plaque should be dried for several hours in warm air before the printer's ink is applied with the rubber roller.



Pressing out the plaque. Plaster of Paris or Keen cement may be used. The former sets quicker, while the Keen cement shrinks away from the form better. Take your choice.

Rough plaque is shown after setting. Below: Coloring the raised portions with a cheap rubber print roller. After the ink has dried, dip the whole plaque in clear lacquer.

Crossing Bell Has Realistic Sound



Wheels passing over tin strip close the circuit, ringing the bell. Strip will not cause the train to bump.

THIS novel crossing bell will clang at short intervals like its full-sized prototype, instead of ringing like a telephone bell. It shows a flashing warning light, and does not require a special section of track with an insulated outside rail.

Most of the parts needed come from a cheap electric doorbell. One wire from the doorbell magnets, which actuate the bell, is connected to the third rail. The other is connected to a piece of tin about $\frac{3}{4}$-in. wide, which is fastened to an outside rail, and insulated from it, by strips of adhesive tape. A more pretentious contact may be built, but the construction just described will be found perfectly satisfactory. The tape may be coated with lacquer, and when this dries the assembly will be held stiffly in place.

There is no circuit-breaking arrangement on the armature. Application of voltage will cause only a single clang, as the armature spring is cut down to prevent buzzing on A.C. supply. As each car wheel passes over the tin strip, it will close the circuit through the other outside rail and sound the bell. Each clang is separate and distinct. A somewhat similar but less well-defined effect may be obtained by using the same connection on a standard crossing bell. The warning light also receives current from the tin strip, and so flashes on and off with the sounding of the bell.

The metal tube standard was a piece of brass from a large mechanical pencil. The piece of stiff wire is used to fasten the standard to the base. It passes up through a hole in the base, between the magnet coils, and is fastened to the base by a machine screw. The lower disc is then soldered on to hold the bell at proper height (note slot to permit passage of the insulated wire, which should be passed through the tube before making the rest of the assembly). Rubber washers are placed above and below the bell. It should not be held tightly, as this will give it a tinny, feeble note, but must be free to vibrate slightly.

The other discs are then soldered on, and the metal tube soldered to one of these. The socket for the light bulb, which is connected in parallel with the magnet coils in the manner shown, should be soldered to the tubing, care being taken not to short circuit to the center contact. The housing is soldered to the upper part of the socket. Glue tinfoil to the back of each red celluloid "STOP" panel, mark the letters on in pencil, carefully edge with a sharp knife point, and peel away from the celluloid before the glue is quite dry. The bright red letters,

[*Continued on page 92*]

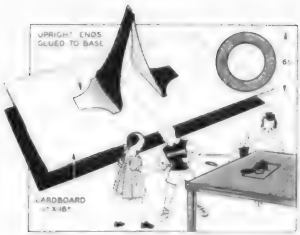
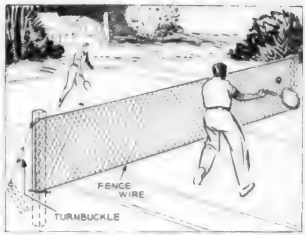


Table Quoits Game

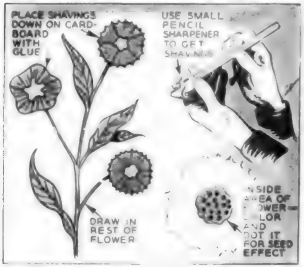
HERE'S a game for the small child that can't damage the furniture, and folds for putting away when not in use. All parts are made from colored cardboard as shown in the drawing. Crease the base for folding or use two pieces fastened by adhesive tape. Six to twelve rings are needed.—*Herman R. Wallin.*



Fence Wire For Tennis Net

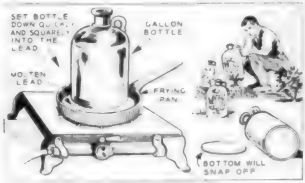
TENNIS nets made of galvanized fence wire can be put up to stay. They will not tear and, since intended for exposure to the elements, do not have to be taken down and stored when not in use. Guy wire and turnbuckle on each post stretch the net.—*J. Modroch.*

Flower Pictures From Pencils



USING a small hand pencil sharpener, a few differently colored pencils, some paper and glue, you can make beautiful flower designs for greeting cards, bridge prizes, etc. Cut a continuous spiral shaving from the pencil and paste it flat around the previously prepared center, as shown.—*Herman R. Wallin.*

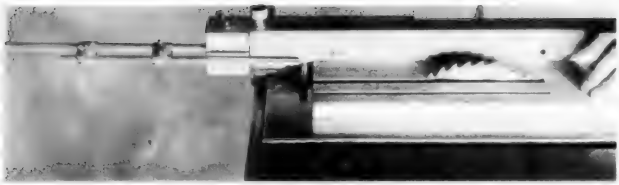
Bell Jars From Cider Jugs



BOTTOMLESS jars to invert over plants for forcing, or to cover specimens, can be made by pushing an ordinary glass jug squarely into a pan of molten lead. Bottom will snap off cleanly, leaving smooth edges. —*A. H. Waychoff.*

Glass Caster Museum Mounts

GLASS casters make excellent mounts for collections of minerals, arrowheads, etc. Fill the cavity with plaster of Paris, then carefully press the specimen down into the plaster.—*Raymond A. Gill.*



Length Gage For Circular Saw

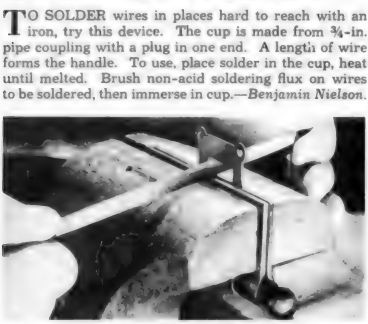
WHEN slotting or grooving it is often desirable to limit the length of the cut. The miter gage stop rods may be used very efficiently for this. Mount them in a wood block fastened to the ripping fence with screws, and used as shown.—*Howard R. Heydorf.*

Soldering Device For Difficult Places

TO SOLDER wires in places hard to reach with an iron, try this device. The cup is made from ¾-in. pipe coupling with a plug in one end. A length of wire forms the handle. To use, place solder in the cup, heat until melted. Brush non-acid soldering flux on wires to be soldered, then immerse in cup.—*Benjamin Nielson.*

Bit Depth Gage

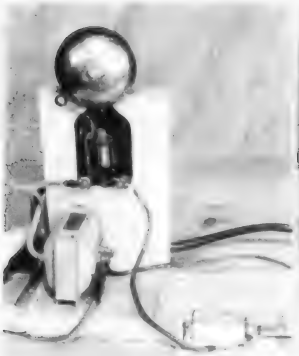
A STRONG paper clip makes a handy emergency depth gage for wood bits or drills. Just clip it on the bit at the desired depth, as shown.—*William C. Willsey.*

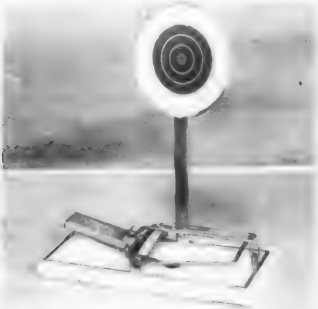


Hinge Holds Small Work

THIN, delicate work can easily be held in a vise without marring its surface. The work is placed between the leaves of a door hinge of suitable size. Hinge is then clamped between the jaws of the vise in the regular manner. —*Howard R. Heydorf.*

MOUSE TRAPS HAVE MANY USES





BOYS practicing with air rifles like to shoot at targets that will reward them with action when hit. When the target shown is struck, it will leap into the air with a loud snap. Target holder is soldered to trigger of mouse trap.

ABOVE IS SHOWN an efficient burglar alarm made with a two-for-five mouse trap. The trap is provided with an electrode in the form of a small square of sheet brass which is placed at a point where the snapper will strike it The wire frame forms the other electrode. A small piece of black thread is attached to the trigger and stretched across the open window or door to be protected. Prowler unwittingly strikes the thread, setting off the alarm. Right: A spring bill holder for kitchen or office. Here the spring member of the trap acts as the clip. A thick pile of papers may be held in this manner.

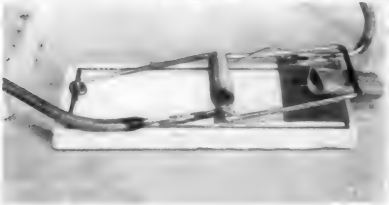
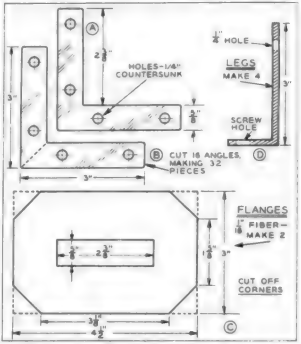


PHOTO FANS will find that a mouse trap makes an excellent holder for 35mm. film while drying. Left: A fire alarm can be made using the same hookup as the burglar alarm described above. In this case the snapper is separated from the electrode by a small piece of paraffin. Should excessive heat melt the wax, the electrodes will come together, setting off the alarm bell.—Raymond F. Yates.

GROWLER ARMATURE

The automotive and electrical mechanic will find this inexpensive piece of equipment an invaluable aid in his business.

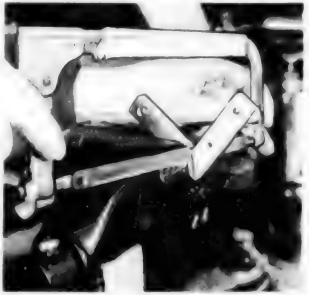
A better magnetic circuit is secured by annealing the angle pieces. After heating to a red glow, bury them in ashes or lime so that they will cool slowly. Leave scale on the metal.



Start with thirty-two complete angles, then cut sixteen of them in half, giving a total of forty-eight pieces. Cut the two side flanges from a piece of stiff fiber or shellacked cardboard.

POSSESSION of a growler enables one to quickly and easily spot short circuited coils, open circuits, grounded windings, commutator bars and other faults which make a generator or motor armature inefficient or inoperative. Without a testing unit of this kind the detection of these troubles is usually a difficult process unless expensive meters are at hand.

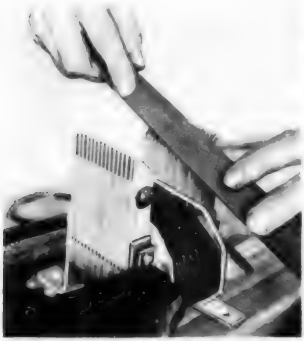
At a cost of about $2.60 or less you can make an armature tester that in performance will compare favorably with a much higher priced outfit. In most cases some of the parts can be obtained from the shop scrap box, cutting down the total cost considerably. You will require 48 flat corner irons, 3-in. by ⅝-in. for the three sided core, costing about 2 cents each at the hardware store. These may be either plain iron or cadmium plated. Remove any projecting burrs from the sides with a file. They may be used without further annealing, if desired, but it is recommended that they be heated to cherry redness and cooled slowly under ashes or lime. This improves the magnetic qualities and increases the efficiency of the core. Do not file the scale off the cooled angles down to the metal; use a stiff brush to clean them. The thin layer of scale acts as an insulator between the laminations, and materially decreases iron losses. Saw 16 of the angles in two to form the angular face of the core. Cut the side flanges from a piece of stiff fiber or shellacked cardboard. Put the core together, thrusting the angles alternately from opposite sides



Clamp the sixteen angles for the pole face pieces in a vise and cut them four at a time with a hacksaw, as shown above.

LOCATES TROUBLES

by W. C. Wilhite

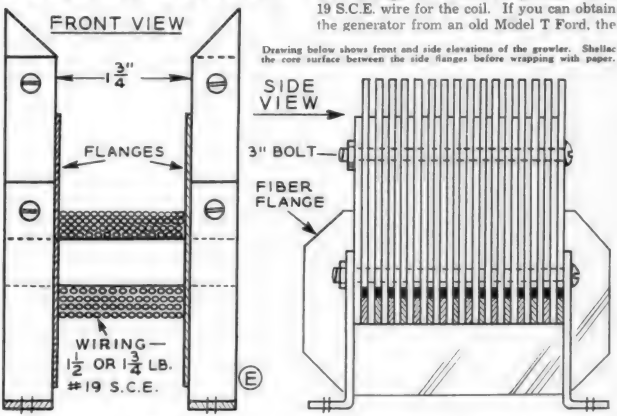


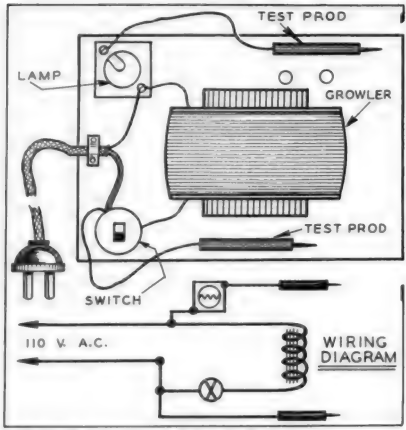
Filing the pole faces permits the armature to make good contact with the core. Use a straight edge for testing flatness.

Iron looses may be kept down to some extent by covering the assembly bolts with several coats of shellac, as shown above.

through the flanges. Slip the cut pieces into the spaces between the vertical legs on each side and bolt the whole together with four ½-in. by 3-in. stove or machine bolts. These bolts should be coated with shellac to prevent interchange of magnetism between laminations. Clamp the assembled core in the vise and true up the pole faces with a file, using a T-square frequently to test the flatness of the armature contacting surface. Apply a coat of shellac to the core surface between the side flanges and wrap three or four layers of Empire paper around the iron. If none is at hand, use ordinary waxed paper or cellophane. Drill a $\frac{1}{16}$-in. hole in one of the flanges to start the winding. Use about 1½ pounds of No. 19 S.C.E. wire for the coil. If you can obtain the generator from an old Model T Ford, the

Drawing below shows front and side elevations of the growler. Shellac the core surface between the side flanges before wrapping with paper.



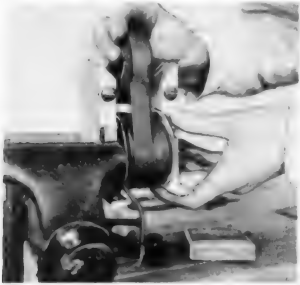


Wiring diagram shows that switch controls growler winding circuit only. Test lamp and prod circuit are not affected.

field coils, spliced together with good soldered joints, will supply just the right amount of wire as each coil contains 6 ounces of this type and size. Bring the outside end of the coil through another hole in the other flange and tape the completed winding as a precaution against possible damage. Remove the two bottom bolts from the core and apply the mounting legs, consisting of ⅝-in. wide strap iron, bent at right angles. This is better practice than fastening the legs in place before winding, as the protruding legs interfere with the winding operation. Mount the completed growler with screws to a wood base made from 1-in. stock, 7-in. wide and 10-in. long. Then place the lamp socket and switch in place, locating the socket so that any armature placed on the core will clear the bulb.

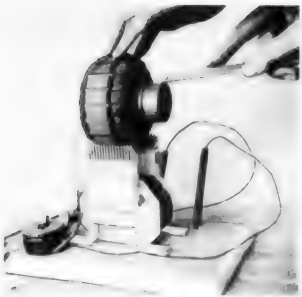
The wiring diagram is shown at left. It will be noted that the switch controls the growler winding circuit only and does not affect the test lamp and prod circuit. By this means the magnetic circuit may be cut off while the armature is probed for grounds with the test prods. After these connections are made the outfit is ready for use.

The first test of a defective armature should be for short circuits, either between turns of a single coil or between points in two adjacent coils. Place the armature between the pole faces and close the switch. A distinct hum will be heard which rises in pitch and volume as the armature is rotated. This hum or growl is what gives this type of tester its name. Hold a hacksaw blade or other thin steel strip



Tape winding before fastening the assembly to the baseboard.

Testing an automobile generator armature for shorts. The flexible blade will be strongly attracted to a short circuited coil between the pole faces, accurately indicating its position.



The open circuit test applied to a Ford Powerhouse type armature. Failure to obtain a spark between the commutator segments indicates existence of an open circuit in the windings.

about ½-in. above the top of the armature and slowly rotate the armature with the other hand. If no short circuit is present the armature may be turned a complete revolution without affecting the blade, but if a shorted coil is turned into the space between the poles the blade will be strongly attracted to the armature. When this occurs, leave the armature stationary for a minute or so. The current induced in the defective coil or coils will cause it to heat up. A finger test at the rear of the coils will then determine accurately the faulty coil.

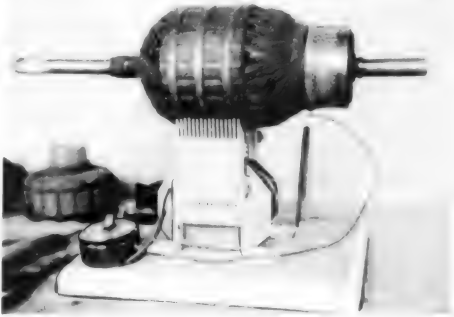
If the armature shows no short circuit, the open test is then made. Rotate the armature as before and, with the edge of the blade, bridge each adjacent pair of commutator bars, breaking the bridge with a snap each time. As long as sparks can be drawn across the bars by this process the coils are intact. Failure to obtain a spark indicates an open circuit or break in the coil connected to these bars.

The ground test may then be made. Open the switch as the growler proper does not have to be used. Hold one test prod on the shaft or a clean spot on the armature core and touch each successive commutator bar with the other prod. If the lamp lights when a certain bar is contacted, the coil connected to this bar is grounded to the armature frame. This test lamp circuit can be used to make continuity tests on field coils, ignition coil primaries, and other apparatus in addition to armature work.

This type of machine is an incomplete transformer. It has a primary winding and three sides of a magnetic core. The armature under test furnishes the remaining parts. The armature coil directly between the pole faces

[*Continued on page* 95]

Feeling for grounded coils on a starting motor armature. One test prod contacts the shaft while the other runs over commutator segments. Lamp lights when grounded coil is touched.



Large armatures are easily accommodated. At right is one from a 32 volt, 500 watt lighting generator up for a test.

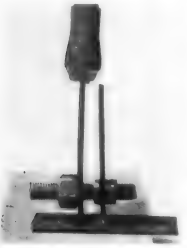
Headphone Used As "Mike"

AN ORDINARY crystal headphone can be used as an emergency microphone with any high-gain amplifier for public-address or amateur radiophone purposes. The output of the phone is about the same as that of a regular mike, and the response characteristics are well suited for voice reproduction. However, a small ½ mf., 200-volt paper condenser, shunted across the phone's terminals, will improve the bass response.

A simple table stand to support the phone is easily improvised out of a short piece of brass rod or tubing and a round or square base of Bakelite or heavy wood.

Bolt Makes Circle Cutter

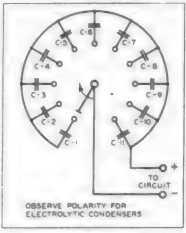
A 5/8" or ¾" bolt about 3½" long makes a simple but effective circle cutter for aluminum, thin steel, etc., as used in radio construction. Drill a hole through the center to take a regular 3/16" drill, which will act as the pilot drill. This is held securely in place by means of a nut run up against it. On the other end of the bolt, saw out a slot about 3/8" wide and 1½" in from the outer end; this slot is parallel with the hole for the center drill. The cutting tool, which is ground from a short piece of a broken rat-tail file, fits upright in the opening, and is clamped in any desired position by means of a nut on either side.



This cutter will make holes from 7/8" to 3" in diameter, for tube sockets, meters, etc. If larger openings are to be made, drill another hole for the center drill near the end of the bolt. The tool should be used in a brace, and turned slowly with firm, even pressure. The work should be placed on a piece of scrap wood, into which the center drill enters. To make clean holes, bore through partially from one side, then turn the work over and finish the job from the other side.—*P. M. Ohlinger.*

Condenser Tester

BY MEANS of this handy substitution condenser tester the correct capacity for any circuit can be quickly determined. The unit can be easily connected to any circuit in which a condenser is to be used. The selector switch is tried in the positions that place in the circuit condensers of approximately the correct capacity. The capacity that gives the best results should then be wired permanently into the circuit. This unit is also handy for determining if a condenser in a circuit is functioning correctly. The unit is connected in place of the condenser under test and if the fault is eliminated, the condenser under test should be replaced.

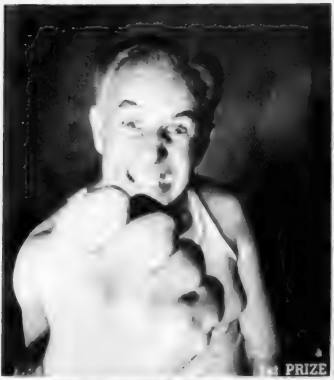


A simple eleven-point rotary switch is used and the eleven condensers used are the most common types and sizes that need replacement in radio sets. These parts are required:

1 11-point non-shorting type rotary switch
1 Indicating plate, 1 to 11
1 Small bar knob for switch
1 C1 .006 mf. 600 v. paper condenser
1 C2 .01 mf. 600 v. paper condenser
1 C3 .05 mf. 600 v. paper condenser
1 C4 .1 mf. 600 v. paper condenser
1 C5 .25 mf. 600 v. paper condenser
1 C6 .5 mf. 400 v. paper condenser
1 C7 1. mf. 400 v. paper condenser
1 C8 2. mf. 500 v. electrolytic condenser
1 C9 4. mf. 500 v. electrolytic condenser
1 C10 8. mf. 500 v. electrolytic condenser
1 C11 16. mf. 500 v. electrolytic condenser
2 Small binding posts, one red, one black.

PHOTOGRAPHY

SECTION PAGES 79-84



1st PRIZE

2nd PRIZE

FIRST PRIZE: "FIST" by Albert Grossman, Portland, Ore. Taken with wide angle lens at f.11 and ½ sec. on DuPont Superior film and developed in Panthermic 777. **SECOND PRIZE:** "BEHIND THE SMILE" by Harry Fujita, Pigmo Beach, Calif. Four exposures; two negatives superimposed on one print. Taken at f. 4.5 and ½ sec. on XF Pan with one 500-w. spot. **THIRD PRIZE:** "DOG BITES MAN" by George Ruston, Oakland, Calif. Taken with Linhof on Agfa at f.8 and 1/100 sec. **FOURTH PRIZE:** "BALANCE" by E. J. Brown, Los Angeles, Calif. **FIFTH PRIZE:** "MOTHER" by M. Pettibory, Mobile, Ala. Taken with Reflex-Korelle at f.2.8 and 1/25 sec. Two negatives printed together.

MONEY FOR YOUR PICTURES

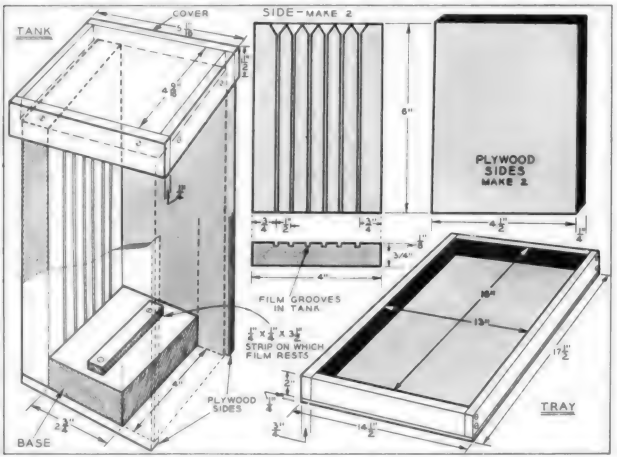
Get busy with your camera and send in unusual pictures of people, animals, machines, trains, airplanes, etc. Each month we will pay $10 for the best picture received from readers, $10 for the second choice, and $5 each for the next three selections. Prints should be glossy, as large as possible up to 8x10 inches (although a small, clear photo is more desirable than a big fuzzy one) and should be accompanied by the following data: make and size of camera, type of film, and how developed and printed, lens opening and shutter speed, and lighting conditions. Wrap all prints carefully, put your name and address on the back of each, and include postage if you want them returned. Address all contributions to Photography Editor, MECHANIX ILLUSTRATED, 1501 Broadway, New York.

5th PRIZE

4th PRIZE

DEVELOPING BOXES

The completed wooden tray easily handles 11"x14" prints. Similar trays can be made for 5"x7" and 8"x10" prints.



OF WOOD

—Are Easily Constructed and Are Made Chemical Proof by Means of Special Paint

AN INEXPENSIVE, chemical-proof paint designed specifically for photographic applications makes it possible for the amateur to build his own trays and tanks at a fraction of the cost of commercial enamelware.

While this paint can be applied to any clean surface, wood is probably the cheapest and easiest material with which to work. A variety of trays and tanks can be made from ¼" plywood and ¾" shelving. We illustrate this with a tray for prints up to 11"x14" and a tank for 3¼"x4¼" cut film.

The inside dimensions of the tray should be 13"x16". The bottom of the tray is cut from plywood, and is 14½"x17½". The sides are made from ¾" shelving cut into strips 2" high. Two pieces 17½" long and two pieces 13" long are required. Flat-head wood-screws secure the sides from the bottom and at the joints. For deeper trays, this shelving is available in standard widths from 4" up.

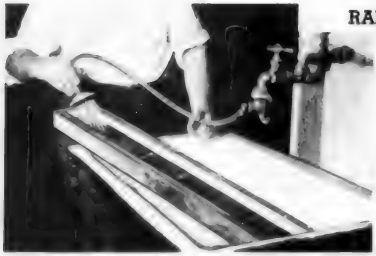
The cut film tank is designed to hold the negatives while pouring solutions in and out. It does not require the use of hangars, in itself a considerable saving. The tank shown here will accommodate six negatives at a time, and requires a 32-oz. of developer or hypo. The bottom and two sides are of ¾" lumber. As shown in the illustration, these pieces should be cut with the grain of the wood in the long dimension, so that the principal assembling screws will have a firm bite. The base is 2¾"x4". the sides 6"x4". Slots are sawed in the side pieces parallel to the long dimensions at ½" intervals beginning ¾" from one end. The bottom and sides are put together so that these slots face each other. The film will then slide into these slots and remain there by their own springiness. Before assembling these pieces, a strip of wood ¼"x¼"x3½" is fastened midway down the length of the base. This will raise the film from the bottom of the tank and allow free circulation of the solutions. It will also be

[*Continued on page 94*]

How cut film slides into the grooves of the film tank. If carefully handled, film-pack negatives can be developed in the same way. Leave paper backing on until fixing is complete.

The parts of the film tank before assembly and painting. At the left is the completed cover. Flat head brass or iron wood screws hold the sections firmly together.

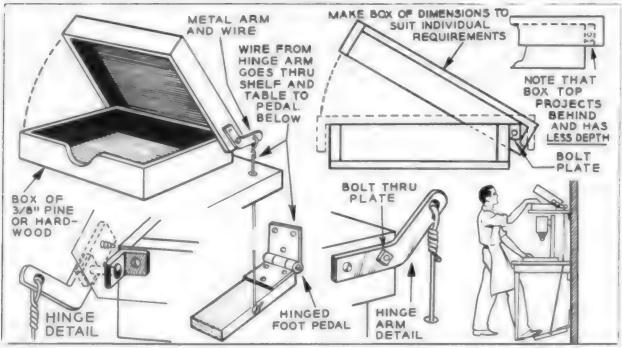
RAPID WASHING TANK



Make the washing tank from four pieces of ¾-in. soft pine. The bottom piece should be ¾-in. wider than the widest film you expect to wash and 6 inches longer than the longest roll. Make sides 2 inches wide and as long as the bottom. Sandpaper surface. Melt paraffine wax and pour hot paraffine all over the inside of the trough. Be sure every part of the surface is covered. All parts should be nailed or screwed together. A lawn watering device served for the hose attachment above. Saw off the left arm. A gas hose nipple was soldered on the end of the right arm. In use, the device is screwed onto the faucet and a piece of rubber tubing is slipped onto the gas stove nipple. Attach a bath spray to the other end of the hose. Pins at base of cut films keep them from touching. Film washes sufficiently in 5 minutes.

RUBBER WASHER

A substitute rubber washer for your tank cover or for any other purpose can be made directly in the lid. Line the space for the washer with plastic rubber from a tube as shown. Allow the rubber to dry over-night before using the cover.



FOOT-OPERATED PAPER BOX

A convenient, foot-operated paper box for the darkroom can be made from the above drawings. Use a light thin wood easy to handle. Dimensions of the box will vary according to the size printing paper generally used. The lid of the box must extend beyond the back to allow space for the pivoting attachment. See construction details above

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OPAL AND GROUND GLASS

Q. What is the difference between opal and ground glass and which should be used in an enlarger?—Roland Rolls, Memphis, Tenn.

A. Opal glass is milk colored, the white being fired into the glass when it is made. Ground glass is glass upon which a screen is made by rubbing a fine abrasive powder over its surface. Its primary use is for focusing the image as it is formed by the lens. Both opal and ground glass are used in enlargers and such glass should be replaced by the same kind as that formerly in the enlarger. Under other circumstances, ground glass in an enlarger should be used when the enlarger casts a circle of light that breaks up the even diffusion of light. In some enlargers ground glass has a heavier screen in the center which thins out at the edges. The effect is to control the light and spread it evenly. Opal glass in an enlarger gives a broad, even light but doesn't concentrate it. Opal glass is generally used when the lamphousing is low or when the reflecting area is dull. If the lamphousing is deep and the reflecting area highly polished, use ground glass.

PREVENTING DEVELOPER OXIDATION

Q. A recent article in Mechanix Illustrated suggested the use of carbon dioxide gas to prevent developer oxidation. Won't carbon dioxide gas react chemically with water and cause the developer to spoil?—Crawford Shepard, Marshall, Mo.

A. Your point about carbon dioxide gas is well taken but there is a slight misunderstanding as to what its action is with water. Carbon dioxide gas does not react with water, as you suppose, but it does dissolve in water, physically. If you place a drop of acid, such as acetic, in most any developer, the reaction will give off carbonic acid gas. The real purpose of the gas is to replace or eject oxygen-containing air from the top of the bottle of developer, due to the carbon dioxide's greater atomic weight. Any heavy, inert gas would do the same thing, but carbon dioxide is more convenient to generate.

MOUNTING CONDENSING LENSES

Q. I am building an enlarger but am at a loss to know how to mount the condensing lenses. Should they be mounted flat sides facing or convex sides facing?—P. L. Horning, Madison, Wisc.

A. Condensing lenses should be mounted with the convex sides facing each other. By no means, however, should the surfaces touch. There should be a slight air space between them of about 3/32 inches apart. The bottom condensing lens should come down as close to the film as possible. In some enlargers the condenser actually fits down hard against the film. The object in mounting lenses this way is to concentrate the light rays and make them converge towards the negative. The use of condensers thus increases the amount of light passing through the film; speeds up the printing process.

EXPOSING PAPER IN DARKROOM

Q. Is it safe to leave photo paper exposed in the darkroom as long as it is out of range of the light from the enlarger?—R. H. Unger, Little Rock, Ark.

A. Theoretically it is safe to leave paper exposed in the darkroom as long as it is not too near or in the direct range of the safe light. But practically, this is a risky thing to do and is not recommended. If left exposed for any great length of time, fog is likely to result. There is also a possibility that light escaping from the enlarger may result in fogging the paper. Even though the safe light may be the only light in the darkroom, it may fog [illegible] if they are exposed to the light for more than several minutes. Keep printing paper in a box or special container and only take out what is needed at the time it is needed—that is the safest rule.

SELECTING ENLARGING LENS

Q. How do you determine what focal length of enlarging lens to buy for a homemade enlarger?—Ralph Hershey, Dubuque, Iowa.

A. The focal length of the enlarging lens should be governed by the largest size film you intend using in your enlarger. The length of the lens should be equal to or over the diagonal of the largest size film you intend using. It is not advisable, however, to use a lens too much beyond the diagonal of the film, as too long a focal length produces a smaller projection and limits the number of times the image may be enlarged.

REVERSAL FILM

Q. What is reversal film? What are its advantages?—R. H. Martin, Rochester, N. Y.

A. Reversal film for movie cameras eliminates the necessity of exposing a negative and making a positive from it for projection. The exposed reversal film is first developed to a negative and then, instead of fixing out the excess silver, the original negative image is bleached out. The residual emulsion is then exposed to light and developed, yielding a positive print. The advantage of reversal is its lower original cost and simplification in processing. It also has smaller grain inasmuch as the larger grains which form the negative image are destroyed before the positive image is formed. However, refined processing of negative material is eliminating this advantage held by reversal film.

REMOVING LINT FROM ENLARGER

Q. What can I do about keeping my enlarger lint free?—Edward Haas, Cicero, Ill.

A. Lint in the enlarger is a perennial problem. Lint usually collects on the film surface, lens and condensers. What makes it hard is that every time the lens or condenser is cleaned with lens paper, the surface is electrified, thus attracting more lint. The best thing to do is to clean each film, the lens and condenser with each picture. This takes time and may seem troublesome, but it is the best way of preventing lint marks from appearing on the print. Needless to say, the darkroom should be kept as clean as possible to minimize the amount of dust and lint floating about.

MECHANIX ILLUSTRATED AWARDS $40 EACH MONTH FOR BEST PHOTOS SUBMITTED BY READERS

The editors of MECHANIX ILLUSTRATED distribute $40 in cash awards each month to the five persons who, in their opinion, submit the best pictures suitable for publication in the MECHANIX ILLUSTRATED Photography section. Full particulars regarding these awards will be found in this issue on page 79.

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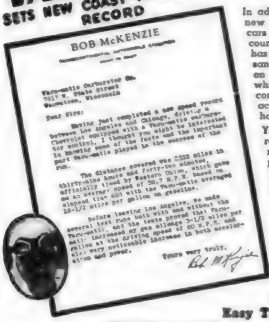

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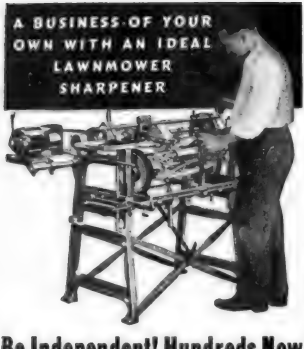

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SHARPEN LAWNMOWERS!

Air Raid! Have We A Defense?

[*Continued from page 45*]

regulated from a transmitter on the ground. When some engineer gets around to enlarging those little robots and making them controllable from another, man-operated ship in the air, that engineer will have an air war weapon that will tax the imagination of mankind.

Today, England is benefiting by its experience in the Schneider Cup races in building modern war planes. It was the British-developed-Supermarine that brought the Schneider cup to England for keeps and established the first world's speed record over 300 miles an hour. By a later racer built by the same outfit, that record was boosted to about 357 miles per hour, and then to 408 miles per hour.

The Schneider Cup Race was the event I tried so hard to get our Navy to build a ship for. I fought everybody in the American aircraft industry in a desperate effort to awaken it to the significance of this international speed contest. This was back in 1929. Our people, Navy as well as aircraft industry, insisted it was merely an international sporting event.

But the British had more foresight in that respect, and today, they are drawing dividends from their racing ships and engines of 1929. Now their Rolls-Royce engines of 1200 hp., and descendents of the Schneider Cup engines, are being installed in a single-seater fighter monoplane known as the Supermarine "Spitfire."

This job is sleek and smooth. Its Rolls-Royce engine is a 12 cylinder, in-line, streamlined, liquid-cooled affair that permits a designer to enclose it in a cigar-shaped fuselage. The "Spitfire" is good for at least 360 to 370 miles an hour, a few miles per hour better than the much talked of [illegible]wker "Hurricane," which seems to be doing [illegible]50. The Hurricane is also powered with [illegible]Rolls-Royce engine, and is a good 55 [illegible]faster than the fastest American [illegible]

I [illegible] "Spitfire" take-off and fly. It's a [illegible] pr[illegible]s a bulky, wooden affair [illegible] the blades can't be changed. [illegible] a retractable landing gear, and [illegible] mounted in its monoplane wings. [illegible]is, it's just a flying machine-gun nest. [illegible]y fast, and can be used only for intercept[illegible]y bombers.

This "Spitfire" is designed t[illegible] and reach the bombers before they car[illegible]ondon. It will never be used outside o[illegible]l, and is a true exposition of the only w[illegible]t can cope with enemy bombers. And [illegible] description of its purpose is that it's the [illegible] arm of the anti-aircraft batteries on tha[illegible] The anti-aircraft batteries can't get [illegible] chase the bombers, and the "Spitfire" c[illegible]ill.

England has the engines t[illegible]e "Spitfire" along, because her air leader [illegible]art enough

to convert their Schneider Cup racing research into fighting machines.

I saw the Supermarine "Spitfire" flown from the airport at Eastleigh but I was somewhat disappointed with its all-around performance. Fitted with a huge wooden fixed pitch propeller, it requires more than a half-mile to get off the ground.

The British say they'll remedy this difficulty by installing the standard modern type of metal propeller whose blade angles can be altered for greater efficiency. But the present wooden propeller weighs about 135 pounds, while a three-bladed modern metal weighs close to 300 pounds. This difference in propeller weight will upset the balance of the "Spitfire," and the British may be forced either to junk this ship or redesign it entirely.

England's dependence on pursuit planes is shown in new air rearmament proposals, which call for between 5,000 and 6,000 high speed, single-seater fighters of various design, and there is logic in this. Anti-aircraft guns aren't nearly as effective as the interceptor planes.

These ships, being small and highly maneuverable, might fit into a war picture in many angles. A host of them turned loose against an enemy army or ground force would paralyze ground operations. Many modern tactical experts seem to believe that an air attack must be in squadron formations, flying at altitudes. Some smart air leader is going to surprise them with an irregularly-spaced, single-seater attack that will upset all defense plans, and anti-aircraft gunnery technique.

Any anti-aircraft gunner will admit that the hardest problem to handle is the attack of swift, little fighters which pounce upon a target from hedge-hopping altitudes. The big anti-aircraft guns are worthless in this kind of wild assault.

In spite of the best defenses a government can provide, about the only suggestion it can offer its citizens is to burrow into the ground or flee to the open spaces when air attack comes.

The antidotes of Air Raid Precautions include a paradoxical feature concerning the clamor for underground and bombproof shelters. The specifications point out that so many bags of sand, three feet on concrete, and so many feet under the ground constitute a safe, bombproof shelter. But in England 2,000-pound bombs are being manufactured which will blow a hole in the ground 100 feet deep. Technical observers in Spain have assured the military that there can be no practical protection for the masses in bomb-proof shelters.

And so, at best the protection for the civilian is makeshift and flimsy, and if bombing squadrons were to attack any big city in Europe today they practically would be unhampered.

One possible method for such an attack astounded me. An observation, by one astute, shrewd air strategist, was that if an air attack could drive enough inhabitants of any great city

[*Continued on next page*]

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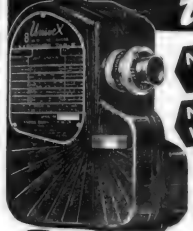

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underground and then keep them running in and out for 48 to 72 hours, that city would be forced to surrender. While I see his point, I think the bombardment might have to continue over a longer period of time.

A determined, concentrated bombardment was tried out on Barcelona shortly before I visited England, and it was the subject of considerable attention there. You may recall the time-table bombings. Many of the British believe that the regular relays—some of them silent approaches, by the way—were not so much to destroy anything material of Barcelona, but instead were executed to gauge the morale of the people and determine the breaking point.

It was during one of such raids that a new bomb appeared and gave rise to much speculation as to its content and qualities. Wild stories had it tagged many mysterious things, but in reality it was merely a high explosive bomb with a long spike projecting from the nose. When this spike strikes the ground, the bomb explodes above the surface.

When a big bomb explodes in the street, the collapse of the atmosphere to fill the vacuum left by the expanding pressure of the blast exerts a suction that draws the exterior walls of the buildings into the street.

Judging from the air force people I talked to in Italy and Germany, as well as in England, the possibility of extensive use of gas during such bombings is rather remote. England tried not to take chances by providing itself with the flimsy inadequate masks, but the consensus of opinion is that gas is a transitory menace and hardly worth the trouble. The wind blows it away. A few explosive bombs in the street will clog it for weeks at a time.

There are, however, a couple of trick bombs to consider. I've had a good look at the new thermite bombs, and I think they're about the nastiest little implements the war factories have produced in some time.

Water has little effect on these small bombs, which are a little more than a foot long and less than two inches in diameter. An average sized plane can carry upwards of a thousand of them, and spray them out like confetti to start as many different fires. And a thousand fires in a city whose streets are cluttered with debris is enough to drive that city to madness.

As the World War ended there were plans to strew thousands of little balls of wax-encased fire chemicals over the wheat fields of Germany. They were to be dropped at night, and the heat of the next morning's sun was to melt them, liberate the chemicals and destroy the grain. Untried 20 years ago, these and many other ideas await the next war and the chance for use.

In my next article, I will discuss the air force of the United States and try to point out its strength and weakness in comparison to foreign air forces.

Army Airmen Start Tests Of New Attack-Bomber Planes

Army Air Corps engineers and test pilots have begun a series of trials of five or six experimental airplanes out of which will come a new and more menacing type of fighting craft for harassing enemy troops—the attack-bomber.

Designed to drop small scatter bombs on troops as well as machine-gun them with its downward pointing armament as it skims along a bare few hundred feet above the ground, the new type plane will replace the attack plane if it is successful, Air Corps officers have indicated. The attack-bomber will be the first plane in the world designed specially for carrying out these missions.

The winning ship which best fits specifications distributed to qualified manufacturers by the army about a year ago, will probably have a loaded or gross weight of 14,000 to 16,00 pounds. Two engines developing at least 2,000 horsepower together will give it quick take-off and a top speed in excess of 300 miles an hour. It will possess exceptional maneuverability to carry out its hedge-hopping duties.

The present attack plane weighs between 10,000 and 12,000 pounds. Two types, the single-engined Northrup A-17 and the twin-engined Curtiss A-18, are in use. The Northrup is standard equipment, while the Curtiss, of which the army has bought 13, is still undergoing service tests. The Northrup has a maximum speed of about 250 miles an hour, the Curtiss between 275 and 300.

Five manufacturers are known to have set out to produce a "physical article" at Wright Field in Dayton, O., site of the tests, by the closing date as required by the terms of the competition. One of them, however, the Northrup division of the Douglas Aircraft Company, has been eliminated through the crash of its entry earlier this year.

The others reported likely to show up with actual planes at the appointed time include Bell Aircraft Company, makers of the army's twin-engined Airacuda fighter; Boeing's Stearman division, builder of training planes for both army and navy; Curtiss Aeroplane, pursuit ship manufacturer; and North American, supplier of army observation planes. A "dark horse" making his entry with the utmost secrecy may also deliver a test plane; this has happened in the past.

The new attack-bomber is distinctly different from the navy plane called by the same name. The navy ship is actually a small dive bomber which carries a single bomb slung beneath the fuselage and which is specially adapted for operation from an aircraft carrier. The army attack-bomber is also much smaller and carries lighter bombs than the 23,000-pound twin-engined Douglas B-18s and B-18-Bs, standard Air Corps equipment.

Advertisers make over 100 free offers in this issue. Why not take advantage of them?

Aircraft Records Approach Limit, Claims Scientist

Record-seeking airmen, who have steadily pushed upward speed, range and altitude marks during the 35-year history of aviation, are now closely approaching the theoretical limits of the airplane as we know it today, Prof. William F. Durand of Stanford University, pioneer aeronautics student and former chairman of the National Advisory Committee for Aeronautics, told the American Association for the Advancement of Science recently.

Airplanes will not be able to climb much beyond 60,000 feet, he predicted. Only a few weeks ago an Italian flyer pushed a specially designed aircraft beyond 56,000 feet. He and others who may attempt a new record are thus narrowed within a band in the atmosphere about 4,000 feet deep.

Two British bombers which recently flew more than 7,000 miles to set up a new distance mark closely approach the 8,000 to 9,000 mark limit, Dr. Durand indicated. This performance is comparatively not so good as some of the other marks, but "when we realize, however, the remote chance, for a period of 60 to 80 hours (the period of flight) of a complete absence of all adverse weather conditions and a continuous perfect functioning, during this period, of all factors contributing to the desired end, the larger margin between actual and ideal performance is not surprising."

If everything, such as load-carrying ability and range, is sacrificed to speed, the scientist said, a speed of about 500 miles an hour should be possible. Already the record is within shooting distance of this mark. The record is now 440.8 miles an hour. But the plane that made it, an Italian seaplane, sacrificed everything to its engine; had only room enough for a pilot and a few gallons of fuel for the speed dash.

Looking ahead on the basis of the past 35 years of aeronautical science, in which Dr. Durand has played a prominent part, the former N. A. C. A. chairman predicted that air transport "within the scope of present vision" cannot become as safe as the safest forms of land transportation.

"I cannot see," he declared, "a reduction of the margin of air transport hazard to a point comparable with the safest of land transportation means. There are too many additional avenues of potential hazard.

"On the other hand, there is hazard in all agencies of transport, a hazard in automobile transport, for example; but we do not, on that account, hesitate to freely employ the automobile. In comparison with the service which it stands ready to afford, we accept this means of transport, with such marginal hazard as there may be.

"In the same way, it is obvious that the air traveling public now accepts such measure of hazard as may inhere in this mode of transport.

Sensational Rides At Fair

[*Continued from page 55*]

the air, and as it flashes around in a circle, a 1-h.p. motor turns the rocket ship completely around so that you fly upside down as well as right side up. The ship itself is a welded tube 15 feet long, equipped with safety belts. As it takes its passengers on a zooming, zipping, dipping, banking, rolling, breath-taking, hair-raising, thrill-packed ride, they can well imagine themselves on a flight to the moon.

As a matter of fact, one smart inventor has devised a ship that takes passengers to Venus, which is part of the way to the moon. Unlike the other rides, his rocket ship never really leaves the ground, but for all the sensation accompanying the trip, you would never know it. This latest is "Flash Gordon's" own rocket ship, designed by George H. Messmore and Joseph Damon. It is 80 feet long and seats 125 people. Once filled, the doors are closed, levers are turned, switches pulled, "anti-gravity" and forward-speed controls are manipulated and suddenly the ship is in darkness. As you watch from the observation tower the ship seems to enter outer space. Familiar constellations flash by and presently the ship lands on Venus. Another door is opened and the passengers alight on a strange planet, where animated images of prehistoric animals and iron-clad "Martians" present a fascinating show. The flight through space is actually a movie flashed on the screen, but the illusion is effective.

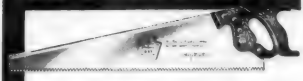
For those who desire to remain on terra firma for their thrills, the midget auto and race track has been brought to the mid-way. Not quite a new invention, its availability as a thrill ride places it in a class with rocket ships. Perhaps the best thing about the midget racer is that it is equipped with its own gasoline engine, and the passenger drives it under its own power. Visitors will be able to drive their midgets around a circular track, with banked turns, at speeds up to 30 miles an hour. To add to the sensation of movement, the ingenious inventor designed a mechanism that moves the track in the same direction as the cars!

Another speedway, using an oval track with flat turns, and fast midgets powered with two-cylinder motor cycle engines of 6 h.p., will add to the enjoyment of fun-seeking visitors. A feature of the cars is the clutch which starts in high without jerking and automatically releases when the engine idles or the car suddenly stops. Another feature is that the brakes operate upon releasing the foot pedal instead of when the pedal is applied, as in standard cars. These features provide added safety. The car is completely surrounded with bumpers. "Plenty of thrills and no spills" is the theme song of this midget raceway.

A variation of the familiar roller-coaster is the bobsled ride devised by Norman Bartlett. The bobsled is hauled to the top of a 65 foot tower,

[*Continued on next page*]

THE SAW OF TODAY



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from which height it flashes down the runways, banking perpendicular on a dozen turns, at a mile a minute. Like the parachute jump and the aerial ride, the bobsled promises to be among the most thrilling rides devised by inventors to give World's Fair visitors a thrill. Framework of the track is of steel ribs with a board track. The sled goes down on casters oiled for speed.

These are no sissy rides, and if it's a thrill you want, you'll get it at the New York World's Fair!

Realistic Crossing Bell

[*Continued from page* 70]

suddenly flashing out from the dark panel, present a very striking appearance.

To make the bell sound longer, and to make it sound before the train reaches the crossing, use two track contactors instead of one, putting one at half the length of the train on each side of the crossing.

The sound of the bell is very loud and distinct, even above the running noise of a large standard-gauge outfit. The clapper can be made from the end of an old brass safety razor handle. It should be fairly heavy and be given a long stroke—about ¼-in.—*John Little Story.*

Rocky Mountain Glaciers Show Recent Growth

Rocky Mountain glaciers are now growing again after almost 10 years of rapid retreat, mountaineers report, as a result of heavy late snows in the higher ranges.

Arapaho Glacier, near Boulder, Colo., reputed to be the largest glacier in the state, is noisily in motion again, after several years of quiescence. When last measured, it was advancing 27 feet a year. This year's motion, according to geologists, may be much greater.

Fair Glacier, whose melt waters are one of the sources of the Colorado River, has grown almost 10 per cent since 1936, photographs indicate, and the other glaciers in the nearby Crater Lake Hellhole are likewise growing.

Glaciers in Rocky Mountain National Park are either growing or holding their own, each glacier being a separate problem.

Glaciologists point out that this year's glacial advance is not evidence of a new Ice Age to come in the near future, but merely the result of a minor climatic variation, of which several have occurred in the recent past. A slight shift toward wetness brings a glacial advance like the one at present; a slight shift toward dryness brings drought and dust-storms, like those of 1934-36. In a few years, they predict, the glaciers will again be in slow retreat as they were in 1928-30.

Building The Flying Wishbone

[*Continued from page* 65]

sanded to about a 1/40-inch thickness at the tips. Crack the stabilizer at the center and create a 1-inch dihedral under each tip.

The rear stabilizer and rudder are cut from 1/64-inch sheet and slotted so that they interlock as illustrated. Tail booms are cut from hard 1/32-inch sheet balsa, 5½ inches long and tapered from 3/32 to 1/16-inch.

Mount the booms on the wing at a point 2⅜ inches from center. After the cement is thoroughly dry, wet the booms slightly with water and join them at the rear. Now cement the small tail surfaces in place.

The wing and front stabilizer are now cemented to their respective mounts. Be sure that all surfaces line up perfectly.

A semi-cut balsa propeller, 5½ inches long, should be purchased and finished off by the builder. It is advisable to coat the prop a few times with cement, sanding it smooth between each coat. This adds considerable strength to the propeller.

Bend a propeller shaft from No. .020 music wire and attach. Slide on a washer and slip the shaft through the thrust bearing. Three strands of 1/16-inch brown rubber are required for power.

As the wing and tail surfaces of this model are not movable and also considering the fact that it is a pusher, the flying of this ship is quite different than if it were of the tractor type. All major adjustments, such as stalling and diving are made by warping the front stabilizer and wing up or down. Warp the trailing edge down to correct a dive or up to correct a stall. Or weight may be added to nose or tail. Turns and banks are made by warping the small surfaces in coordination with the large surfaces.

The propeller is wound counter clockwise instead of clockwise as on tractor models. When proper adjustments have been found, wind the propeller up until one to two rows of knots appear in the rubber. Launch as shown in photo.

Scientists Report New Plant

Discovery of a plant quite unlike any other plant now on record has been reported by Drs. W. C. Coker and Leland Shanor of the University of North Carolina. It is an alga, related to the green thread-like lower plants that form green films on ponds late in summer. But unlike them it is not green and hence cannot form its own food. It is pallid like a fungus and like a fungus it lives on food already formed. It was found in water draining through a burning sawdust pile.

Russian campers at the North Pole report that fresh food gets stale in summer, even in that supposedly ice-box region.

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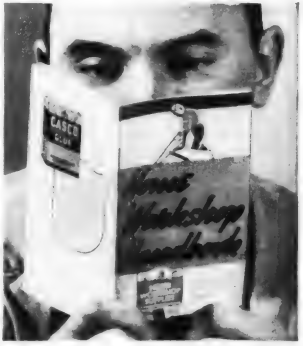

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Developing Boxes Of Wood

[*Continued from page* 81]

found helpful to widen the top of each slot so that they can be more easily located when working in total darkness.

The remaining sides are of plywood, 4½"x6". A cover, which may be found desirable, is simply made by fastening plywood strips to a ¾" base. About 1/32" clearance all around should be allowed.

The important thing in making such equipment is to cut and fit the parts accurately. Sandpaper and a small plane will be found useful if one happens to slip up a bit on the sawing. After assembling, the inside cracks should be sealed with plastic wood. This will go a long way towards making the job water-tight.

Two or three coats of the paint should be applied to the inside surfaces of the box and the tray, each layer being allowed to dry thoroughly before the next is put on. The liquid is black and a bit thicker than ordinary paint, being more like thin asphalt. A single coat on the outside surfaces will suffice, to prevent the wood from absorbing water when the containers are washed.

Indicator Warns Plane Pilot Of Approaching Stall

An indicator to warn the airplane pilot that his plane is about to "stall" has been patented by Raymond P. Holland, Jr., of Kenmore, N. Y. The device takes advantage of the fact that the relative vacuum above the airplane wing suddenly disappears when the plane is about to stall. The change in pressure, according to specifications for Patent No. 2,110,730, which covers the invention, operates a gauge which warns the pilot that he is approaching a "stalling altitude."

A "stall" occurs when the angle between the wings and the air stream reaches such a high point that the wing's ability to lift the plane suddenly disappears.

A vane device for the same purpose has been worked out by research workers of the National Advisory Committee for Aeronautics, but its use has been limited primarily to experimental planes. The Holland patent has been assigned to the Curtiss-Wright Corporation.

Brown University's new chemical laboratory will have "unsurpassed" facilities for research in photochemistry and electrochemistry, two lines increasingly important in science and industry.

Apparently, only one photographer has ever been lucky enough to snap the picture of a falling meteorite.

Growler Locates Troubles

[*Continued from page 77*]

is the secondary winding while the core bridging the growler gap completes the magnetic circuit. Never attempt to use this apparatus on direct current as an instant burnout would result. Also, be sure that the coil of the growler is not energized unless an armature is in place. Otherwise an excessive current, probably large enough to burn out the winding, will flow. The presence of an armature core closes the magnetic gap and this iron circuit offers great enough reactance to keep the current down to a safe value.

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Astronomers Find "Waltzing" Star With Invisible Partner

A star that carries on an unending waltz through space with a dark partner that no one has ever seen, was described to the National Academy of Science recently by Drs. S. A. Mitchell and D. Reuyl of the Leander McCormick Observatory of the University of Virginia. The star is known as Ross 614.

The weaving motion of the star can be traced, the scientists reported, indicating that it is whirling round and round a massive stellar body like itself, as do all the familiar double stars in which both members are bright, but the companion here is invisible. A somewhat similar case is that of the giant dog star, Sirius, which has a massive companion whose light is exceedingly faint. But this is the first recorded case of a companion star that is totally invisible.

Since 1935, engineers stationed in a skyscraper in downtown New York have photographed and recorded every lightning storm in the summer time to study lightning strokes.

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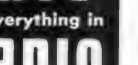

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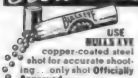

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Modern Miracle

[*Continued from page 39*]

substances smell exactly alike to the human nose. Also calculated to trick the senses are synthetic flavors made from gases and tars which yield solutions that taste like wintergreen, vanilla, pineapples, pears, or strawberries.

The miracles continue to mount up. By mixing hydrochloric acid (made from common table salt) with acetylene gas, laboratory workers got a complex material that automatically split up into two parts. One of the fractions, when properly treated, is chemistry's closest approach to natural rubber. The list is seemingly endless: there are synthetic cosmetics, machine-made camphor, artificial leather, and coal-tar vitamins.

The modern miracle of synthetic chemistry has only just begun. New laboratories are springing up and new research is going on. More natural gas is being nabbed from the earth's interior and many substances that were once rubbish are daily being reconverted into useful materials. In my next article, I will tell the story of Plastics—synthetic's prize product—whose secret the chemists have unraveled.

British Aeronautical Expert Given Guggenheim Medal

The Daniel Guggenheim Medal for 1938 has been awarded to A. H. R. Fedden, Chief Engineer of the Bristol Aeroplane Company of England "for contributions to the development of aircraft engine design and for the specific design of the sleeve valve aircraft engine", it was announced recently by Major Lester D. Gardner, Secretary of the Board of Award. Mr. Fedden is an Honorary Fellow of the Institute of the Aeronautical Sciences and a Fellow of the Royal Aeronautical Society. He is regarded as one of the foremost designers of aircraft engines in the world.

The Daniel Guggenheim Medal Fund was established in 1928 to provide a gold medal and certificate to be presented annually in recognition of notable achievements in the advancement of aeronautics, in commemoration of the support given by Daniel Guggenheim to the advancement of aeronautics through donations to the universities and for the encouragement of civil aviation. The fund is administered by nine directors designated by the American Society of Mechanical Engineers, the Society of Automotive Engineers and the Institute of the Aeronautical Sciences. The recipient of the award is chosen by the directors and foreign representatives from England, France, Germany, Holland, Italy and Japan.

According to one astronomer's calculations, the planet Jupiter is covered with an ice sheet 16,000 miles thick.

College Students Prepare Synthetic Diamond

Under the direction of Dr. J. Willard Hershey at McPherson College, in McPherson, Kansas, synthetic diamonds have been prepared by successive groups of graduate students. Here is the simple formula for making diamonds:

Mix two parts of chemically pure iron filings with one part of pure sugar carbon, by volume. Place in a graphite crucible and heat to a temperature of at least 4,000 degrees Centigrade for a little over an hour. Then remove the crucible and plunge into a freezing solution of ice and salt brine. Treat the hardened mass with hot aqua regia for 300 hours to dissolve the iron and digest the residue as much as possible with various acids. Finally search the remaining carbon dust for the diamonds. Use a microscope in the search, for any diamonds will be very tiny. But they will be diamonds which is what you started out to make.

But seriously, the simple statements above have required a great amount of research to bring them about. When Dr. Hershey began the year there was no way in which temperatures of 4,000 degrees could be controlled in a fashion required in the research. And there was the problem of building a fire brick furnace that could withstand the high temperatures.

The continued research has shown that the formation of the diamond seems to depend on how fast is the cooling of the heated mass of iron and carbon. This cooling, and the tremendous pressures which are built up inside the iron-carbon mass during cooling, seem to turn black carbon into the transparent carbon which man calls a diamond.

Build Laboratory To Test Streams' Sediment Load

A laboratory designed to test the sediment-load of streams has been built by the Works Progress Administration of North Carolina across Rocky Creek in Iredell County for the U. S. Department of Agriculture. Sedimentation studies will be the aim of the Soil Conservation Service work at this station.

Spanning the stream, 14 concrete veins spaced five feet wide adjoin concrete and stone revetments. Four feet below each section is a 16-inch pipe, leading to a pump house. Hydraulic oil cylinders permit a sample of each or any vein to be pumped into the vats.

Qualitative and quantitative analysis of the samples will be made to determine from the suspended load when bed load of sediment is carried by the stream under all conditions.

Similar devices are being installed at Greenville, N. C., and Dadeville, Ala.

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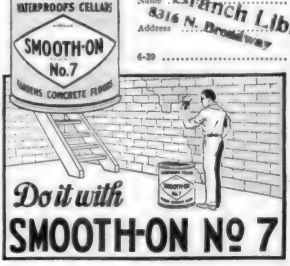

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Future Airliners Will Have Radial-In-Line Engines

Aviation's big argument—between supporters of the radial engines so familiar in the United States and proponents of the in-line engine whose cylinders are lined up one behind the other—will be settled in the big engine field by a compromise. Tomorrow's giant engines will be both.

Developing thousands of horsepower, these engines will count their cylinders by the dozen instead of one at a time. And when that happens, engineers declare, the most likely arrangement will be several in-line banks arranged radially around the crankshaft—almost like a lot of radical engines placed one behind the other until enough cylinders have been piled up to develop the power aeronautical engineers must have to move their giant creations.

Where today a 14-cylinder engine is considered large, tomorrow power plants deriving their kick from 36, 48 and even more cylinders will be required.

These huge engines will drive many-bladed propellers to take advantage of the greater power available. Today's largest propeller is 15 feet in diameter; tomorrow's will be somewhat larger.

The controversy over radial and in-line engines has raged in aeronautical engineering circles ever since European planes, powered with in-line engines that have only a fraction of the frontal area of radial powerplants, began piling up speed records. America, which has stuck to the radial engine, is accused of backwardness in this one respect at least.

But supporters of the radial engine in the United States have plenty of arguments up their sleeves. One of them is a record of years of reliable operation. Another is the superior maneuverability of a plane fitted with the flat radial engine. With its weight concentrated within a short distance along the plane's axis instead of being distributed along it, the plane equipped with a radial engine can turn more sharply than any other type. Pilots are still arguing, as a matter of fact, which is more desirable—extremely high speed or great maneuverability. You can't have both. That argument (and the argument over engines themselves) won't be settled until actual combat between the two types of craft in some future war.

But for the big planes the argument will simply be eliminated by development of the engine that is a cross between the two types. This is true whether diesel engines become the rule or not. It applies to any engine whose crankshaft is turned by pistons kicked by gas exploding in a cylinder. And that will be the primary source of aircraft power for years to come: combustion turbines and other radically new forms of powerplant aren't even around the corner.

"Comfort Meter" Counts Eye Blinks In Lighting Study

Designed and developed by two research scientists employed by a well known electrical products manufacturer, a new "Comfort Meter" provides an improved method of measuring and comparing degrees of human fatigue induced by various visual tasks by recording the frequency and electrical nature of the subject's blinks, the involuntary split-second movements of the eyelid during a person's waking hours.

The complicated electrical devices comprising the "Comfort Meter" automatically record the number of blinks per minute which correlate with the ease and comfort of the subject (foreground) while reading under various lighting conditions. Minute electrical currents generated in the blinking process are picked up by tiny electrodes that touch the skin near the subject's eyes, being held in place by a tape attached to the subject's head, as shown in photo. A wire leads from the tape to the "Comfort Meter" and the electric currents are amplified millions of times by the device before finally recording the frequency and electrical nature of the blinks on a chart in the form of wavy line patterns. Results obtained from the tests are being applied to provide the public with proper light distribution, proper typography and conditions in general conclusive to best seeing with least effort.

Dr. Marston T. Bogert, recipient of the Priestly Medal, the highest award of the American Chemical Society, predicts that the day is in sight when, if necessary, our food could consist of capsules or pills of concentrated, scientifically correct synthetic nutrients, although at present this would be too expensive.

A study of vacuum machines at two state experiment stations indicates that most machines clean best moving at a speed of one to two feet a second.

It's time to remove the anti-freeze from your car! Also a whole winter's accumulation of rust, scale, sludge and sediment! They clog the delicate veins of the radiator. The motor overheats. You waste power. You may find yourself with an expensive repair bill on your hands.

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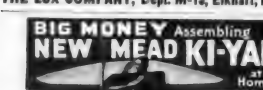

Patents System For Sending Colored Television Images

A system whereby natural color television can be produced has been patented by Robert Harding, Jr., of White Plains, N. Y.

Operating on a combination of the basic principles of color photography and color printing of television image transmission, the method relies on super-position of primary colored images to achieve the desired effect according to the specifications accompanying the patent.

Color filters and suitable lenses break up the scene to be televised to produce one image for each of the basic colors. These images are then directed at a special scanning disc to be converted into electrical signals for radio transmission.

At the receiving end, the signals are converted into light signals in a similar manner, except that the process takes place in reverse. Separate primary color images are then combined to produce the colored image.

Mr. Harding's method differs from the Bell Telephone company's color television system, demonstrated in 1929, in that the latter uses color filters placed before the photoelectric cells that turn light into electric current. In the latter three separate banks of light sensitive cells are required. In Mr. Harding's system lenses and filters separate the colors even before scanning and a single set of photoelectric cells is used.

Color television has not received nearly the same attention as has black-and-white radiovision because of the necessity felt by radio engineers of solving the relatively simpler problem first. In addition, color television as worked out both by Mr. Harding and the Bell engineers requires the use of a mechanical scanning disc, no longer in general television use because of serious mechanical difficulties.

Neon Tube "Hen" Finds Lost Radium Valued At $600

Nine years ago, eight milligram needles of radium were left by mistake in some new surgical dressings at the Royal Victoria Infirmary, Newcastle-on-Tyne, England. A few days afterward the loss was discovered and physicians searched the cinder track where the refuse from the hospital incinerator had been dumped. No trace was found of the valuable needles.

Recently a neon tube radium detector was purchased and a new search of the cinder track was made. Embedded with the cinders, the needles were found after some days of search, according to the London correspondent of the Journal of the American Medical Association.

This detector, developed a couple of years ago, is called a radium hen, because it clucks. The searcher wears head phones and the nearer the "hen" gets to the radium, the faster the clucking.

Static Suppressor Developed For Aircraft Radio

Culminating five years of laboratory and flight research for a device to eliminate aircraft radio static interference, United Air Lines recently announced the successful development of a static suppressor insuring normal reception of both the directive beam and voice radio signals irrespective of the intensity of static conditions.

The device, installed in the tail of the airplane as shown above, is electrically released from the pilot's cockpit. When the pilot encounters a radio static condition, he presses a button which electrically releases a wire in a slip-stream, its full length trailing behind the plane. The static electricity, which formerly leaked off various parts of the plane, is discharged harmlessly through the suppressor. Each plane carries a reserve wire.

Aviators Organize League

Following the example of the nation's amateur radio operators who, as far back as 1914, recognized the need for unity in their ranks and organized the American Radio Relay League, a group of aviators in New York, N. Y., recently organized the Airplane Pilots League with headquarters at 516 Fifth Ave., in an effort to unite the 40,000 student pilots and 21,000 licensed pilots now engaged in private flying activities.

Membership in the newly organized League is limited to persons holding a student pilot permit or higher pilot license. There are many aero clubs in the country, but most of them accept flyers and non-flyers as members. By limiting its membership to flyers, the League hopes to attain a position where it will be accepted as the true representative of the nation's airmen by Washington and state aviation officials.

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Flexible Fireplace Curtain Eliminates Spark Danger

Hung from a bar strung across the fireplace opening, as shown above, a newly developed wire mesh curtain effectively prevents sparks and cinders from flying into the room, thus eliminating the usual fire hazard. Since the curtain is flexible, it slides open at the merest touch of the finger on a small knob.

Italian "Hummingbird" Plane Weighs Only 150 Pounds

Built on the lines of a duck but named "Hummingbird" ("Colibri"), a new pint-size light airplane is attracting considerable attention in Rome, Italy. It is the invention of an Italian engineer, Quinto Beltrame.

The "Hummingbird" plane is a little less than 12 feet long and has a 20-foot wing span. Its weight, empty, is 150 pounds. It can take off in less than 150 yards, and its landing speed is under 40 miles an hour. At a cruising speed of 87 miles an hour its radius of action is something over 300 miles.

It is a pusher plane, its propeller powered with a one-cylinder motor. It has no rudder, and its horizontal balancer is placed forward. In general, the little craft gives the impression of flying backwards.

It is estimated that on a quantity production basis the "Colibri" planes can be produced for 12,000 lire ($631.60) each.

A Cornell University professor has developed a process of gassing vegetables and getting rid of the water in them, so that they can then be stored without rotting, freezing, or molding.

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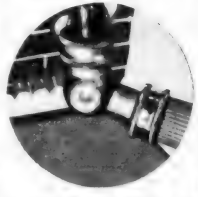
Swivel Hose Coupling Eliminates Breakage



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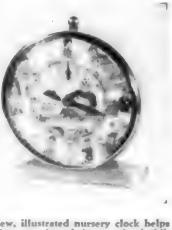
Illustrated Nursery Clock Helps Mother Plan Child's Day



A new, illustrated nursery clock helps mothers regulate their pre-school children's daily routine. Around the clock at correct intervals are pictures of elves going through the major points of a child's routine—eating, sleeping, washing, etc. Small numerals inside the border of pictures enable grown-ups to tell the time, although the clock has only one hand in order to simplify its use by children. The clock has standard works and can be used as an alarm.

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WINDCHARGER Light Plants. We show you how used car generators make inexpensive windchargers. Instructions 10c. Wesco, 823 Terminal, Minneapolis, Minn.

Scientists Seek Solution To Mystery Of Magnetism

The mystery of magnetism has been puzzling the best minds of the world ever since that unrecorded day when man first picked up a natural lodestone and found that it strangely attracted bits of iron to it.

For thousands of years only a curiosity, the lodestone was finally discovered—probably in China—to have the additional power of indicating north if it was suspended on a string. The earth itself was later found to be a giant magnet.

Through the ages man's uses of magnetism have increased to all the ramifications which make possible today's present electrical era; for magnetism and electricity were found to be closely related. But even the mystery of the potent power of earth magnetism was present, and only partially explained.

Seeking some answer to the riddle scientists, the world over, have probed deeper and deeper into matter and into smaller and smaller chunks of matter until they were studying the magnetism present in the atoms themselves.

But let Dr. M. A. Tuve of Carnegie Institution of Washington tell the story as he does in Scientific Monthly. " . . . there is one really outstanding puzzle which all our knowledge of physics is still unable to explain, namely, the enormous permanent magnetic field of the earth . . . We now have measured the deepest forces within the atom, we have, so to speak, chased magnetism all the way down to the smallest particles inside the atom, but we still have no clue to why the earth and the sun have such large magnetic fields, each related to their direction of rotation."

Dr. Tuve is referring to studies measuring the fundamental force which is found in the nucleus of atoms and which binds them together. The discovery of this attractive force has been one of science's outstanding finds of recent years.

The giant teredo, a shipworm of the tropics, may grow to be six feet long and as big around as a man's arm.

An Egyptian pharaoh founded one of the world's earliest botanic gardens over 3,000 years ago, at Karnak.

Nitrogen, says a British astronomer, is far less abundant on the earth than in the stars.

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STAMPS! 100 diff. 3c; 500 diff. 35c; 1,000 diff. 90c! Illustrated Album (4000 spaces) 22c. Approvals sent. Tatham Stamp Co. (D9) Springfield, Mass.

ONLY Mussolini Stamp Free to those sending 5c for 100 Different Stamps. Approvals included. Wineholt Co., Box M, Woodbine, Penna.

FIJI (scarce) included—Forty country mixture—100 stamps, 10c; 300, 25c. No approvals. Guy Eben, Bowling Green, Ohio.

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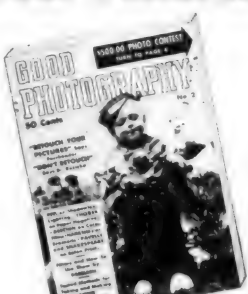

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Polarized Light Bringing Industrial Revolution

A new industrial revolution is in the making and it will be created out of light. Practical applications on a large scale are foreseen now that man can create and control the kind of light that vibrates in one plane only. This kind of light is called "polarized light."

What the vacuum tube, familiar in our radios, did for applied electricity, a cheap and convenient means of polarizing light promises to do for optics.

For many years the polarization of light has been understood and used in a limited way. Expensive Nicol prisms, made from suitable crystals of Iceland spar, have long been used in microscopes and other optical instruments. The effects of polarized light have long been demonstrated in classroom physics experiments.

It is startling to have light blotted out by a mere twist of a disc that had been perfectly transparent. This happens when the prisms are "crossed" or arranged so that their "one-way streets for polarized light" block each other.

The new development in polarized light is the commercial production of large sheets of polarizing material, called Polaroid. Millions of small, needle-shaped crystals of the chemical, sulphate of iodo-quinine, are laid down in a film, which may be a yard or more wide and continuous in length. This synthetic sheet polarizes perfectly.

Some of the practical applications are: A desk lamp that eliminates glare from papers on the desk.

Sunglasses that rub out sunlight reflections on pavements, sea, ice and snow.

Elimination of auto headlight glare by use of 45 degree polarizing screens on headlights and windshields of all cars.

Photographic filters for surface reflection elimination.

Colored illumination and advertising displays.

And the most promising of all, perhaps, stereoscopic or three-dimensional motion pictures in color.

Miner's Taught Coal Carving

The world's first and only school for carving coal has been started in Beuthen, Germany, it is reported.

Disabled miners with some ability in carving and whittling will learn at the school how to carve a particular grade of coal, known as gagat, which is suitable for working into ornaments.

Gagat, aside from amber, is said to be the only ornamental stone that is vegetable in origin. A gagat "diamond," dating back to the stone age, is on view in the Ethnological Museum in Berlin. Carving gagat has become quite an industry during recent years.

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English Military Publication Praises U. S. Destroyers

The U. S. Navy's new torpedo craft are lauded as superior to comparable British and Japanese boats in a recent issue of *The United Services Review,* leading English military journal, which also gave high rating to the new American six-inch gun cruisers.

The new boats, says *The Review,* "are splendid units, combining an exceptionally formidable torpedo armament with a satisfactory speed and reasonable gun power."

The U. S. Navy now possesses 40 new destroyers and 13 flotilla leaders, with 36 of both types under construction and 55 more authorized. These will replace the torpedo-craft fleet of world war days, which at the close of hostilities was the greatest in the world but which has since become wholly obsolete.

The new-type destroyers displace 1,500 tons apiece, and the flotilla leaders 1,800 to 1,850 tons. Both types were designed for a speed of 37 knots, but on trials have exceeded 40. This is equivalent to about 47 land miles per hour.

Main armament of the destroyers consists of sixteen 21-inch torpedo tubes in four quadruple mounts, two on either beam. For fighting other destroyers and repelling aircraft, they carry four 5-inch dual-purpose guns, mounted on the center line, and a number of machine guns.

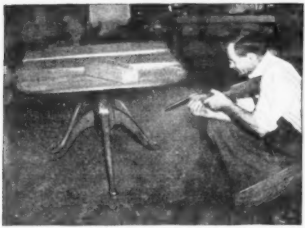
This is compared to the armament of new British and Japanese destroyers by *The Review,* to the disadvantage of the latter two naval types. In comparison with the British boats, "They are slightly faster, somewhat more heavily gunned, and carry a greatly superior torpedo armament. They compare even more favorably, at least from the standpoint of speed and torpedo armament, to Japan's new destroyers of the 'Sigure' class (1,368 tons, five 5-inch guns, eight torpedo tubes, and 34 knots.)"

The new U. S. flotilla leaders carry fewer torpedo tubes (12 as against 16) but more guns. They have eight of the five-inch pieces, mounted in pairs in gun-houses on the center line. This arrangement, plus the single massive funnel instead of the row of three or four that have been customary on torpedo craft, gives the boats something of the appearance of light cruisers; and indeed with a broadside of eight 5-inch guns they do have a fire power approaching that of a small cruiser.

The Review concludes: "With the completion . . . of all these destroyers, authorized as well as building and appropriated for, the U. S. Navy will possess 144 modern, under-age boats displacing some 228,000 tons—a very formidable force, indeed, and one which will be equalled only by that of the Royal Navy."

If you are interested in any of the items mentioned in this issue, send a stamped, return envelope for the address of the manufacturer.

Blast Of Birdshot Pellets Makes Furniture "Antique"



If you want to provide old furniture with a real antique appearance, blast away at it with birdshot (No. 80) fired from a sawed-off .22 caliber rifle, according to John Gaar, of Milwaukee, Wis., shown demonstrating the technique. The borings made by the pellets can hardly be differentiated from those made by wood-boring worms after years of work.

Real Transatlantic Race Is Airplane vs. Liners

Air travel is about to span the most densely traveled ocean, the North Atlantic. Whether the joint American-British service gets under way this summer or next will not alter the fact that the conquest of transoceanic skies is assured. The real race now is between airplanes and express steamers.

Such ships as the Queen Mary and the Normandie are luxury liners in more ways than one. They are expensive to run, piling up a little more deficit with every mile of their wakes. The losses are charged to national prestige of the nations whose flags they fly.

The general idea is that air transportation is always more expensive than water transport. Of particular significance therefore are the computations by experts that show that actually it vill cost less to fly a passenger across the Atlantic han to carry him across on a ship like the Queen Mary. The cost per luxury liner passenger is iven at $67, while with a 150-passenger plane, ıch as will undoubtedly be built in the next few ears, the cost would be only $37. These are operting costs. The fares to be charged will be higher, ncluding overhead and terminal charges.

Illinois has a fleet of trailers equipped as fuel ıspection laboratories, to test the gas sold at iling stations.

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New Ideas for Home & Shop

Names and addresses of manufacturers of products described below will be sent free to any reader on request, provided a stamped, return envelope accompanies the inquiry. Mention date of issue when writing.

Designed specially for handling 2x2-inch slides, a new low-priced projector uses a 100-watt lamp and features a lens with a focal length of 5 inches and a speed of f3.6. Assuring safety for color films, the projector's housing is said to remain cool enough to handle at all times.

Clothespins made of a plastic material which hold garments firmly without damage to delicate fabrics.

A lady's compact with a special device that cleans the mirror every time it is opened for use.

A cleaning material which counteracts odors without creating another.

A solution that enables amateur photographers to do developing and fixing simultaneously with the same non-staining solution. It is said to provide fine grain results as well as save time.

An all-wood table for typewriters that can be assembled or taken apart in about half a minute.

An electric range which is only 19½ inches wide yet has an insulated oven, a self-starting oven timer, a broiler compartment and three surface burners.

An insecticide for roaches, ants, etc., that is non-poisonous to humans or pets but which will destroy the vermin and their eggs without any deteriorating odors.

A low-priced spray machine that will spray lacquers, enamels, varnishes, etc., to any surfac Powered by a ¼-horsepower AC electric motor

A record player that operates through a radio, yet is not connected to it by wires of ar kind. Operates on 110-volt AC electric currer

Powerful horseshoe magnets for workshop u which are capable of lifting 50 times their ow weight.

A wind driven electric generating plant which can be made from an old automobile generator plus a few other easily obtained parts. Catalog is 10c.

Fitting over the edges of any 2x4-in planks, these teeth-lined clamps per a carpenter's "horse" to be assemb in a few minutes. Adjustable bc enable proper pressure to be appli

A new powered work shop-drill on which the drive mechanism is fully enclosed.

A portable battery-operated radio receiv featuring a weather-proof, airplane cloth-cover cabinet with a handle for carrying. Needs aerial or ground connection.

A kit of machined parts for assembling a mini ture gasoline engine for model planes.

Replacing cumbersome tape measures and wooden rulers, new gauge can be used to measure any flat or curved surf merely by rolling its wheel over the surface. The whee connected with a calibrated dial which provides an accu reading. Nose gauge reading "4" over 4-inch mark on ru